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Tactics and Maneuvers for Attack Helicopter Simulations

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Chapter 1

The Development and Design of the AH-64A Apache

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Chapter 1

The AH-64A is *the* best attack helicopter in the world today, although its development was often in doubt. There was constant bickering between the Army and Congress over increasing costs and the need for such an aircraft. The famous UH-1 Huey and the first true attack helicopter, the AH-1 Cobra, had performed well in Vietnam and were battle tested. Why did we need to go through the long and expensive process of designing and developing a completely new aircraft? The answer to that question involved a number of areas.

Engine performance. The AH-1 Cobra was of single-engine design, and in conditions such as those experienced in Vietnam, this single engine could not deliver the necessary performance. Often weapons loads had to be decreased in hot weather to accommodate enough fuel to perform the intended mission. This lack of engine performance also limited the aircraft's quick-maneuver ability.

Firepower. Because of the small size of the AH-1, it carried a limited amount of firepower. Due to the increased weight when fully armed, it had a very limited range. The Army determined that to be effective in the modern battlefield, it would be necessary for a helicopter to carry a large quantity and variety of arms.

Survivability. The helicopters of the Vietnam era were basically modified civilian or transport vehicles, and, as such, they were not properly designed to take a great deal of damage and continue to fly. Most were susceptible to severe damage from small-arms fire.

Figure 1-1. The AH-64A

The result of the Apache development program, a fully loaded AH-64A over the skies of Western Europe.

The SA-7 missile. In the late 1960s, the Soviets began to deploy the SA-7 hand-held surface-to-air missile. This event radically changed the proposed tactics for future attack helicopters. Up to that point, the Army had envisioned attack tactics similar to those used in Vietnam (where the helicopters would fly at high speed at treetop level to deliver gun and rocket attacks). Operating in this manner would make them sitting ducks for the easily transported SA-7. The Army realized that future attack helicopters would need to operate below the treetops, down among the trees. This placed a lesser emphasis on high speed and a greater emphasis on maneuverability.

All-weather flight. Harsh weather conditions, such as those frequently experienced in Western Europe, would ground the existing helicopter force or severely limit its ability to carry out a successful attack. There was a definite need for an all-weather attack helicopter which could operate on the front in Western Europe in heavy rain or dense fog.

Proposals for a New Helicopter

Congress was finally convinced of the need for this new helicopter and in August of 1972 the AAH (Advanced Attack Helicopter) program was officially announced. In October of 1972, RPVs, or requests for proposals, were issued to the aircraft contractors. The Army wanted to build a helicopter which would meet the following official requirements:

★ Cruising speed of 145 knots
★ Ability to carry eight TOW antitank missiles
★ Operational time of 1.9 hours
★ Ability to withstand load factors of +3.5 to −1.5 gs at gross weight
★ Ability to withstand hits from .5-inch heavy machine guns and 23mm cannons
★ Ability to land on a hard surface at a vertical speed of 42 feet per second with a forward speed of 15 knots

Production proposals were received from Lockheed, Hughes, Boeing-Vertol, Sikorski, and Bell. The design engineers soon found that since none of their existing air frames could be modified to meet the stringent requirements set down by the Army, a totally new aircraft would have to be drawn up.

The Army continued to examine the concept while evaluating the proposals and became concerned about the TOW missile's range. Getting close enough to fire this missile would put the aircraft within range of many enemy air defense systems. The Rockwell Hellfire missile was in the early stages of development but offered a range of six kilometers. Though still unproven, the Army made a wise decision and changed the specifications to include the Hellfire in place of the TOW.

In June 1973, it was announced that the proposals submitted by Bell and Hughes had been accepted and funds would be provided to each firm to develop their designs to a point where a competitive fly-off between the two aircraft could be performed. This competition was to take place in July of 1976.

Since the AH-1 was the previous standard for attack helicopters, it was not surprising that the helicopters designed by both companies took on a similar shape (but on a much larger scale). At 13,000 pounds, the Hughes design weighed twice as much as the AH-1. Both helicopters were of twin-engine design built around the GE YT700 engine.

The major differences between the prototypes devised by Bell and Hughes were that the Bell design used a two-blade rotor as opposed to the four-blade system chosen by Hughes, and Bell chose to put the pilot in the front seat whereas Hughes put the copilot/gunner in the front. There were also differences in the main transmission and tail rotor assemblies. The Bell design was assigned the designation YAH-63; the Hughes model was assigned YAH-64.

The two companies worked furiously and on Sept. 30, 1975, the Hughes YAH-64 flew for the first time. The Bell design flew for the first time the following day. The two aircraft were handed over to the Army for competitive testing in mid-1976, and, by December, the Army had reached a decision. The winner was the Hughes YAH-64.

Why the Hughes YAH-64?

This choice was made based on a number of reasons, the two most important of which were that the four-blade rotor would allow the Hughes model to operate in more confined areas due to its smaller diameter and the landing gear of the Hughes model had a wider stance. This made it more stable on sloping terrain.

Phase II of the program was now facing Hughes, and they had problems already. The Ford Administration had approved $200 million for this phase of development, but when Jimmy Carter came into office, this amount was cut to

$100 million. The Congress disagreed and reinstated funding in the amount of $165 million. This compromise amount allowed the Phase II program to be finished in 56 months, just 6 months longer than proposed under the $200 million figure.

Producing the Hughes YAH-64

A number of changes were made during this period. The tail design was changed several times. The exhaust ports for the engines were redesigned to make it harder for the aircraft to be tracked by heat-seeking missiles.

Designs for the targeting system and the night-vision system were evaluated. In April 1980, Martin-Marietta was chosen over Northrop to provide the Target Acquisition Designation Sight and Pilot Night Vision Sensor (TADS/PNVS). The Martin-Marietta system had performed flawlessly during testing, scoring three out of three hits with Hellfire missiles. Despite the continuing successful record, the project still faced opposition in Congress due to costs and was lucky at several points not to be canceled.

A major test of the Apache was conducted in mid-1981 in the form of an operational test. This test lasted for three months and tested the aircraft performance in a number of simulated battlefield encounters (sometimes as many as four battles a day), as well as projected targets for reliability. By the time these tests were through, the three aircraft used in the test had flown over 400 hours, most in simulated combat with ground forces. Finally, after complete evaluation of the results of the operational test, the go-ahead was given for full-scale production in April 1982.

As the first order for production aircraft was being entered, funding problems arose. The Senate Armed Services Committee refused to release the required money, and the Apache supporters had to repeatedly fight the concept that there was a cheaper way to acquire a first-rate attack helicopter. Once again they had to explain why the AH-1 Cobra could not be modified to meet the standard. The Committee was finally convinced when told of a plan offered by West Germany to improve the Cobra. This plan would take four

Figure 1-2. Apache Helicopters Being Tested in Arizona

more years to develop, and the resulting aircraft would still be four times more vulnerable than the current AH-64A. With the support of the Committee and General Rogers, the NATO Commander, the go-ahead was given for production of 48 aircraft—with the total production run to eventually reach 515.

In 1983, the giant corporation put together by Howard Hughes was being taken apart (due to his death in 1976), and Hughes Helicopter was sold to McDonnell Douglas. The deal was finalized in January 1984 with a total purchase price of $470 million. Under the leadership of McDonnell Douglas, new facilities were constructed, and, by September of that same year, the production line was up and running with a goal of three Apaches per month.

Figure 1-3. Apaches Currently Rolling off the Line at 12 per Month

Chapter 2

The AH-64A Apache

Chapter 2

The Apache, as delivered to the Army in its final form, is without question the best attack helicopter currently operating anywhere in the world. It has been received with overwhelming praise by the military community. To examine this aircraft and gain some understanding of what makes it so special, it's necessary to look at it as a group of subsystems—each designed with special requirements in mind.

Structure

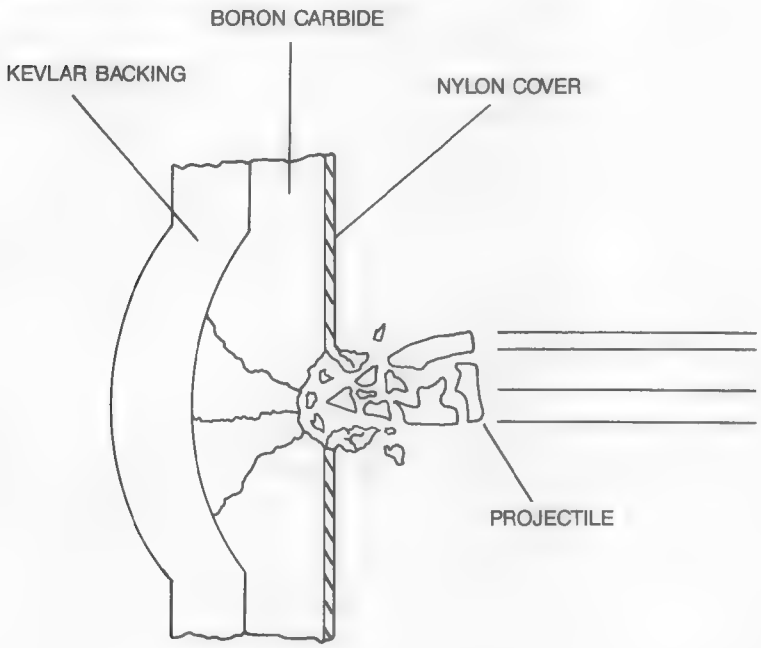
Unlike most aircraft, the chassis and skin of the Apache do more than just serve as a supporting structure and enclosure. This machine was designed to operate in the middle of a battlefield, and as such, taking hits is unavoidable. The basic structure of the AH-64A allows it to get hit and still continue to operate.

The crew area, the drive systems, and the hydraulics are covered with *high-impact armor* and *fragmentation shields.* This armor is designed to stop the 23mm High Explosive Incendiary cannon projectile fired from the feared Soviet ZSU-23-4 Shilka mobile antiaircraft gun. The rest of the aircraft is, for the most part, invulnerable to fire from .5-inch gun armor-piercing shells.

The parts of the aircraft which are not armor covered are either redundant or deliberately made oversized in order to continue to function when damaged. The main drive shaft could be three inches in size and still perform well, but by increasing the size to seven inches, it's capable of taking a direct hit and continuing to function.

Figure 2-1. An AH-64 Apache Fully Loaded with Hellfire Missiles

Figure 2-2. Impact-Resistant Armor



The crew and vital components are protected by armor composed of bonded boron carbide and Kevlar. When a projectile, such as that fired by the ZSU-23-4, hits the armor, the projectile and the boron carbide both fracture, absorbing much of the energy. The Kevlar backing then gives and expands to absorb the remaining energy and prevents the shrapnel from entering the aircraft.

An example of redundancy is the dual-engine design. Either engine can support the aircraft by itself in all flight modes, including hovering. The engines are also placed as far apart as possible to prevent both from being damaged by a single shot or by an engine explosion.

As mentioned, the crew members are protected by armor and bulletproof wind screens. They are also protected by a transparent blast screen which is located between them. This screen prevents both of them from being harmed by an

explosion in the cockpit. Each crew member is flight qualified; flight controls are located in both compartments.

The aircraft is protected as much as possible because everyone understands that crashes in battle are inevitable. The Apache is built to take it. The whole structure is built to be load absorbing, and the landing gear are designed to collapse if necessary to protect the main body of the aircraft. Crash tracks run the length of the crew area to give support to the nose in the event of a crash. These tracks also contain the chain gun and keep it from damaging the fuel cells (which are also crash and damage resistant).

Engines

The AH-64A Apache is powered by two General Electric T700-GE-701 turboshaft engines. Each weighs about 420 pounds dry (without oil and fuel). Each produces 1690 horsepower under normal conditions. Should one engine fail, the other could produce over 1700 horsepower for a short period of time—enough to get the crew safely to the ground if necessary.

The transmission and gearbox for each engine are extremely sturdy. The gearbox can run without oil for 30 minutes, and the transmission can run dry for 60 minutes. This GE engine was designed with forward-area (battlefield) maintenance in mind. The engine covers fold down to provide a stable platform for repair crews to work from, and frequently serviced components are located within easy reach. Most items can be replaced by a single man in ten minutes.

Engine exhaust has always been a problem. These hot gases form a clear target for heat-seeking surface-to-air missiles. To combat this problem, passively cooled exhaust ducts, called black holes, were developed. This system brings in cool outside air and mixes it with the hot exhaust gas before venting it outside the aircraft.

Figure 2-3. AH-64A Apache Attack Helicopter

An Apache loaded with eight Hellfire missiles and two 19-tube rocket launchers.

Storage Options

One of the main reasons for developing the Apache was the need for a system that could carry a large variety and quantity of weapons deep into enemy-controlled areas. To meet this need, the AH-64A was designed to transport the following items:

★ 7-tube rocket launcher and 2.75-inch rockets
★ 19-tube rocket launcher and 2.75-inch rockets
★ Quad Hellfire antitank missile launcher with four missiles
★ Five-inch (127mm) Zuni heavy rockets
★ 230-gallon long-range fuel tanks
★ AGM-84 Harpoon antiship missiles
★ M230 30mm chain gun

★ Quad TOW antitank missile launcher and missiles
★ Penguin antiship missiles
★ AGM-122A Sidearm antiradar missiles
★ Stinger air-to-air missiles with dual launcher
★ AIM-9L Sidewinder air-to-air missiles

Some of these weapons systems will be examined in greater depth in a following chapter.

Aircraft Performance

Unlike some previous helicopter designs, speed was not the prime focus for the development of the Apache. This aircraft was intended to fly at speeds in excess of 100 knots at an altitude of 15 feet or less! In order to safely fly in this manner, an aircraft must be nimble and reliable. At an altitude of 15 feet, you do not have much time to react to system failures.

Fortunately for current and future Apache pilots, the AH-64A has exceptional handling ability. It has been tested and approved to take maneuvering loads of between +3.5 and −0.5 gs. This allows for hard-turning maneuvers needed to fly low and fast. The excess of power available from the twin engines frees the crew of the worry of losing power and altitude during nap-of-the-earth flying, as was common with the AH-1 Cobra. The negative *g* ability allows pilots to stay close to the ground when coming over the top of a hill. Once they see that they are clear of the crest, they can pitch down hard and reduce the amount of time that they are exposed to ground detection and fire.

The specified combat weight for the aircraft is 14,700 pounds. At this weight, the Army required a climb rate of 450 feet per second in hot, desert conditions. The Apache, as delivered, can climb three times as fast as the specifications—1450 feet per second. The Apache is also capable of carrying much more weight. It is rated at a maximum load of 5000 pounds, which is more than can be stored in weapons currently.

Despite being a very complicated machine, the Apache has been described as one of the smoothest and easiest-to-fly helicopters currently in the U.S. military. The DASE (Digital Automatic Stabilization Equipment) allows the pilot extended hands-off flight when moving forward or to maintain a hover when stopped.

Although not designed for speed, the Apache can hold its own with a maximum level flight speed of 164 knots. Its nimbleness is again demonstrated by the ability to fly backwards or sideways at 45 knots.

The amazing thing about the Apache is that it can demonstrate all of these abilities, including nap-of-the-earth flight, in extremely bad weather and at night, with very little, if any, loss of performance. It can do this because of the high-tech avionics equipment it carries. We'll examine it next.

Avionics

Avionics are the eyes of an aircraft, and the Apache probably has the best eyes of any helicopter in the world. The sensors aboard this aircraft are totally integrated; that is, they act together. This greatly reduces the work load and response time of the crew in battle conditions. A sensor system is specifically designed to meet the demands of each crew member's job function. These systems are known as TADS/PNVS.

TADS. The TADS (Target Acquisition Designation Sight) is primarily used by the copilot/gunner, or CPG. This system allows the gunner to see, identify, engage, and destroy targets at great range in day or night. To perform this task, a wide range of sensors are at the disposal of the gunner:

★ *Direct-view optics.* This system is for daytime use. It is basically a variable-power telescope with the image displayed in the gunner's cockpit via the Optical Relay Tube.
★ *High-resolution TV system.* This is an alternative sensor for daytime use. However, due to its ability to operate in the near-infrared range, it may prove to be of more use than

the direct optics in real battlefield conditions. The infrared allows it to "see" through some of the smoke and dust which will likely be present on the battlefield.

★ *FLIR (Forward Looking InfraRed) sensor.* This sensor allows the gunner to search for and detect targets at night or in bad weather, including rain and snow.

★ *Laser system.* This is the range finder and tracking system for laser-guided weapons such as the Hellfire missile or smart artillery shells.

The information from these sensors is displayed in several ways. The HDD (Head Down Display), is a binocular-type eyepiece through which the gunner looks. It sticks up out of the control panel directly in front of the gunner. A video display screen, or CRT, is also used.

The most innovative and unique system is the IHADSS HDU (Integrated Helmet Display Sight System Helmet Display Unit). This helmet has an eyepiece attachment which displays sensor images and information on a clear piece of glass in front of the wearer's eye, much the same as a heads-up display in a jet fighter. The helmet is coupled to the movable sensor housing in the nose of the aircraft. To provide the appropriate images and target data, the sensor housing turns when the wearer's head turns. This is the *what-you-see-is-what-you-hit* targeting system. The laser will point where the gunner looks to guide Hellfire missiles. The 30mm chain gun is also slaved to the sensors; so, to aim the gun, all the CPG has to do is look at a target.

PNVS. The PNVS (Pilot Night Vision Sensor) is generally used by the pilot to navigate the aircraft at night or in bad weather. The system provides a brightly illuminated view of the ground and allows the pilot to fly nap-of-the-earth maneuvers even in total darkness and rain. Infrared imaging is used by the PNVS which displays the image of the terrain on the eyepiece of the IHADSS helmet. Since there is no magnification on this system, the pilot sees the infrared image superimposed over the view outside. The helmet operates in the same manner as the gunner's, so the view changes

accordingly when the pilot's head is turned. The pilot can even look *through* the bottom of the cockpit by simply looking down since the sensor for the PNVS is located in the nose of the aircraft and is not blocked by the fuselage.

The PNVS also displays such vital flight data on the eyepiece as airspeed, altitude, and heading. This lets the pilot fly without having to look down at the instrument panel.

Countermeasures

To survive in the modern battle environment, an aircraft needs to be more than tough; it must have the technology currently available to confuse the enemy weapons and make them miss. The Apache contains state-of-the-art countermeasures equipment.

Enemy weapons systems are aimed in one of four ways: They are aimed optically, they are aimed with radar, they are laser-guided, or they are heat-seeking (infrared). There is not much you can do to confuse visually aimed or laser-guided weapons other than flying low or at night.

The Apache is fitted with a system to alert the crew that they're being illuminated by a laser. Once they know that they're being targeted, they can react and try to break the lock. Radar and infrared systems can be fooled with the proper technology.

For radar-guided weapons, the Apache contains the APR-39 radar warning receiver. This receiver alerts the crew to radar operating in the area. The system displays the direction from which the radar signal is coming on a small CRT screen. If the crew realizes that the radar has locked onto them, they can use the ALQ-136 radar jammer to analyze the radar signal and generate the necessary jamming response. Metal chaff designed to produce a large radar reflecting cloud can also be used.

Heat-seeking weapons are confused by the ALQ-144 IR jammer. It creates a changing source of infrared energy designed to create errors in the guidance system. M-206 IR flares can also be dropped to lure the weapon away from the

aircraft. The engine exhaust ports were designed to disperse the heat as widely as possible to decrease the intensity of the Apache's heat or IR signature.

Figure 2-4. Apache Attack Helicopters in Service at Ft. Hood, Texas.

A flight of five Apaches involved in a training exercise at Ft. Hood, Texas.

Chapter 3

Helicopter Aerodynamics

Chapter 3

To the casual observer, how a helicopter flies is fairly obvious. The big propeller on top goes around and lifts the helicopter off the ground. Well, that's basically how it works, but in the course of getting from point A to point B there are a number of subtle forces and operations at work. In order to fully understand how the aircraft functions, and to master the flight skills necessary to be a great attack helicopter pilot, one must understand these various forces and operations.

The Rotor

In actuality, the spinning blade on the top of a helicopter has much more in common with the wings of an airplane than it does with the propeller. In order to fly, an airplane needs the lift provided by the wings moving through the air. Much the same is true with the helicopter. It gets its lift from a set of rotating wings called rotors. Hence the name *rotary-winged aircraft.*

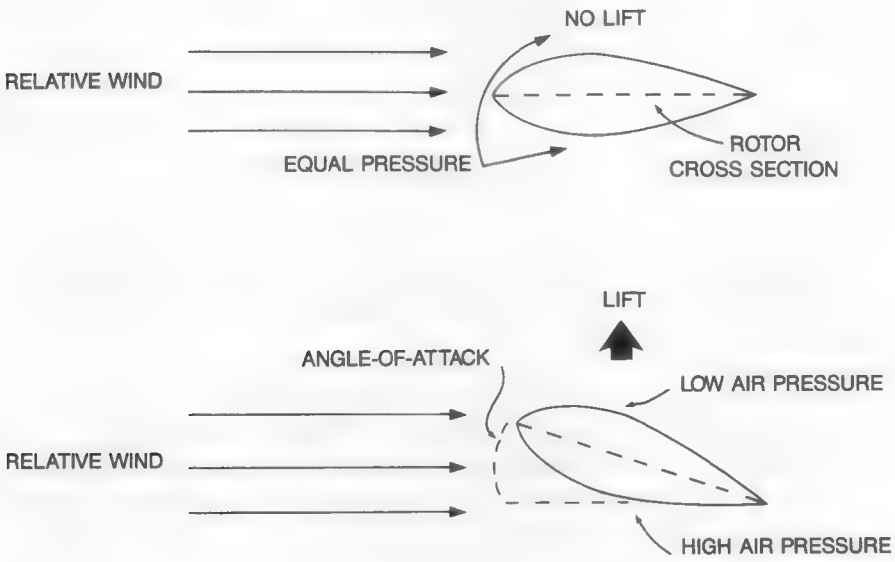
Wings of airplanes and helicopters generally operate in the same manner, with the main difference being in the source of the *relative wind.* In order for a wing to produce lift, it must have air passing over and under it. Airplanes generate this relative wind by pulling the wings forward through the air in a fixed position. Helicopters generate this relative wind by attaching the wings to a spinning mast and rotating them above the aircraft. In this manner, helicopters can generate lift without the forward motion of the aircraft. This gives the helicopter its main advantage over fixed-wing aircraft—the ability to take off and land vertically and to hover in a fixed position above the ground.

Figure 3-1. An Apache Helicopter Tilted Forward in Forward Flight

Vertical Control

Vertical maneuvering, or moving the aircraft up and down, is done by changing the pitch of the rotor blades to increase or decrease lift. This is accomplished by using the *collective stick,* so called because it changes the pitch of the rotor blades together (or collectively). In going up and down, only two forces are at work: lift and weight. In order to go up, the pilot pulls up on the collective stick which increases the lift of the rotor. Once this lifting force is greater than the weight of the aircraft, up it goes.

Figure 3-2. How Changing the Collective Stick Controls Lift

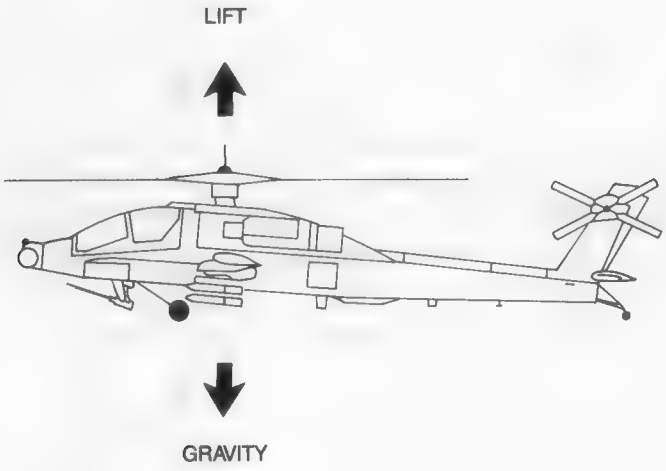


By changing the pitch angle of the rotor with the collective stick the pilot can control the amount of lift produced and cause the aircraft to rise or fall.

When the collective is in the neutral position (top) it has a small angle-of-attack to the relative wind and as such, pressure on the top and bottom of the rotor is roughly equal. No lift is produced.

When the collective is increased (bottom), the angle-of-attack, or pitch, is increased. This causes the air pressure on the bottom of the rotor to be greater than the pressure on the top, producing lift.

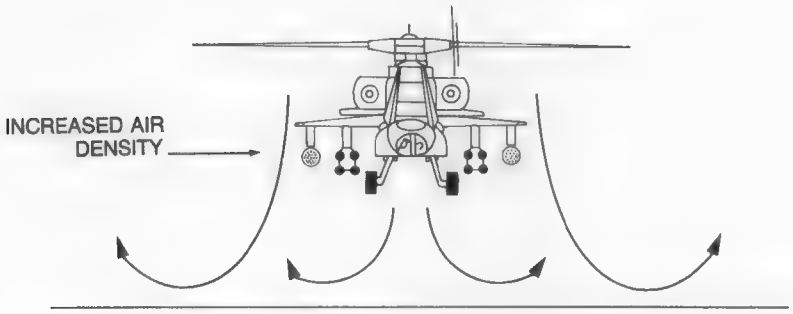
Figure 3-3. Hovering



A hovering helicopter is in a constant battle between gravity and lift. When lift exceeds the pull of gravity, the aircraft rises. When lift is reduced, gravity takes over and pulls the helicopter back towards the ground.

Getting the aircraft off the ground initially is aided by an effect called the *ground cushion*. This is what happens: Due to the strong downward force of air generated by the rotors and the closeness of the ground, the air becomes compressed, and this increased density of the air causes an increase in lift close to the ground. Once you reach a certain height, the air has room to spread out and is no longer compressed, and then more lift is needed to climb further. With the AH-64A, the ground-cushion effect goes away at an altitude of 12 feet.

Figure 3-4. Ground-Cushion Effect



As a descending helicopter approaches the ground, the downwash from the rotor blades is trapped, creating a "cushion" of denser air. This air increases the lifing ability of the rotor blades. A further decrease in the collective is necessary to land the aircraft.

To descend, the pilot pushes down on the collective stick, which decreases the pitch of the blades, causing a decrease in lift. Once the lift force is less than the weight of the helicopter, gravity does the rest, and the aircraft descends. Once close to the ground, the ground cushion may make a further decrease in the collective necessary.

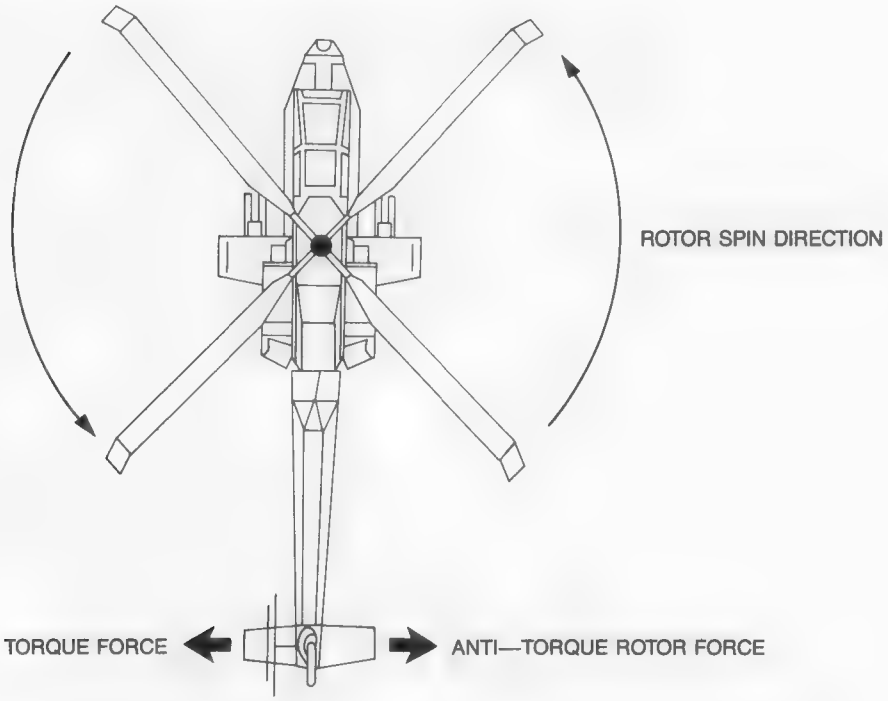
The Anti-Torque Rotor

Another force that affects the helicopter is *torque.* Torque is a force that is the reaction of the engine turning the rotor. When the engine turns the rotor, there is an equal-and-opposite reaction that tries to turn the body of the helicopter in the opposite direction. Anyone who has had an electric drill spin out of their hand when the bit became lodged knows what torque can do.

So to keep the body of the helicopter from spinning around and around once it leaves the ground, the Anti-Torque Rotor was developed. This is the small propeller you

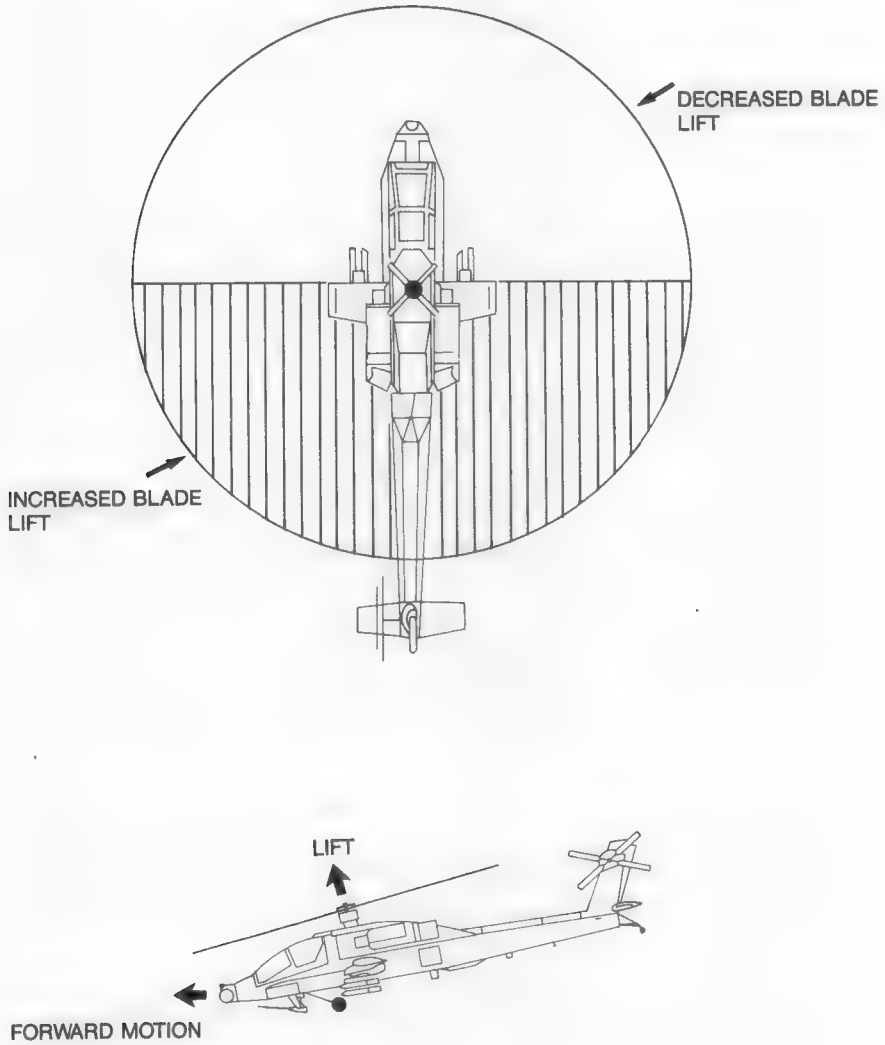
see spinning at the end of the aircraft fuselage. When this rotor spins, it creates thrust in the opposite direction of the torque force. The amount of force generated by this rotor is controlled in a manner similar to the way the lift of the main rotor is controlled. The pitch of the Anti-Torque Rotor can be increased or decreased by using a pair of pedals at the pilot's feet. In this manner, the pilot can control the amount of force generated by this rotor and keep the aircraft pointed straight ahead. The pilot can also use this control to turn the aircraft while in a hover.

Figure 3-5. Anti-Torque Rotor Action



As the engine spins the rotor blades, the torque produced tries to spin the body of the aircraft in the opposite direction. The Anti-Torque Rotor produces thrust to push the tail and oppose the force of the torque. When these forces are balanced, the aircraft will remain pointed in a fixed position.

Figure 3-6. Cyclic Control



Pushing forward on the cyclic stick increases blade lift during the back portion of the cycle and decreases lift during the front part of the cycle (above). This results in a tilt in the rotor disc (below) and forward motion.

Control in Forward Flight

An aircraft that can only move up and down is not much use to anyone. To perform useful tasks, the helicopter must be able to move from point A to point B in a controlled manner. How the helicopter accomplishes this is one of the subtle operations I mentioned earlier.

A helicopter will fly in the direction that the rotor disc tilts. If the disc tilts forward the aircraft will fly forward, and so forth. The problem is that the gyroscopic force generated by the spinning blades tries to keep the blades spinning in the same dimensional plane. The disc does not want to tilt.

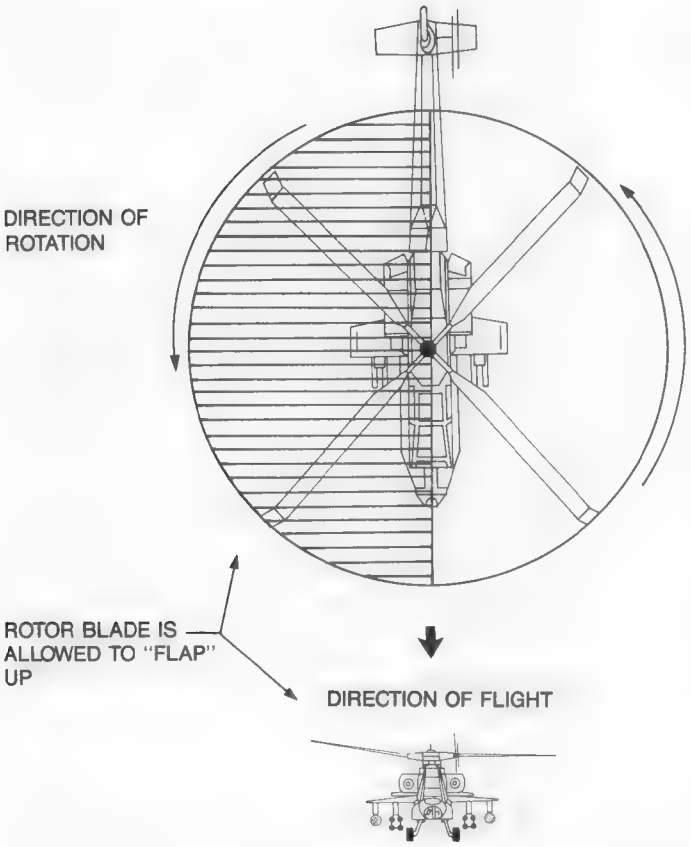
The solution is to make the disc tilt itself. This is accomplished using the *cyclic control stick,* so called because it changes the rotor blade's pitch for just one portion of its cycle. Pushing forward on the cyclic stick increases the pitch on the rotors during the back half of the cycle. This increases the lift for this portion of the disc. At the same time it decreases the pitch during the front portion of the cycle and causes a decrease in the lift for that part of the disc. This imbalance in lift causes the rotor disc to tilt forward—making the aircraft move in the forward direction. Moving the cyclic stick to the right, left, or back causes a similar tilt of the rotor disc and aircraft movement in that direction.

Cyclic Control

When the helicopter moves forward, a number of interesting things happen. As the forward speed increases, the aircraft suddenly starts to climb without a change in the collective control. This is due to *translational lift.*

This lift is caused by the rotor blades moving forward into undisturbed air. When this occurs, the blades become more efficient and an increase in lift results. This can be compensated for by decreasing the collective and total lift or by tilting the nose of the aircraft further forward. Thus, you increase the forward speed and decrease the amount of lift being generated straight up. Once a compromise is reached, straight and level flight will result.

Figure 3-7. Rotor Flapping



When a helicopter is moving forward, the rotor blade varies in airspeed during its spin. If the helicopter is moving forward at 100 mph and the blades are spinning at 400 mph, then the 100 mph forward motion of the aircraft is added to the 400 mph speed of the spinning blade, giving the blade an airspeed of 500 mph when it's spinning toward the front of the aircraft. This speed difference causes an increase in lift during this part of the cycle and is compensated for by allowing the blades to flap, or tilt up.

Another result of forward flight is known as *dissymmetry of lift.* One of the things that affects how much lift is generated by wings or rotor blades is the speed at which it is moving through the air. When a helicopter is moving forward, each rotor blade is moving in the direction of flight half of the time and away from the direction of flight half of the time.

When the blade is rotating forward, its speed is the sum of its rotational speed and the aircraft's forward speed. When the blade is rotating rearwards its speed is the rotational speed minus the forward speed of the aircraft. As a result, the blade generates more lift while rotating towards the front of the aircraft than it does while rotating towards the rear of the aircraft. This difference in lift causes the helicopter to want to flip over onto its back.

To prevent this from happening, each blade is attached to the mast, or hub, with a hinge. This hinge allows the blade to flap up during the faster portion of its cycle, thus dissipating the extra lift, and down during the slower part of the rotation. By allowing the rotors to flap in this manner, the overall lift of the blade can be equalized over the entire rotation. The centrifugal force of the spinning blades keeps them from moving too high or low.

Autorotation

When an airplane loses engine power, it can trade altitude for speed and glide for a short distance and land. A helicopter pilot can perform a similar maneuver known as *autorotation.* An aircraft high in the air has a gravitational pull on it which creates a *potential energy.* This altitude can be traded for speed or *kinetic energy* by descending. Speed is needed to keep air moving over the wings of an aircraft so they continue to produce lift.

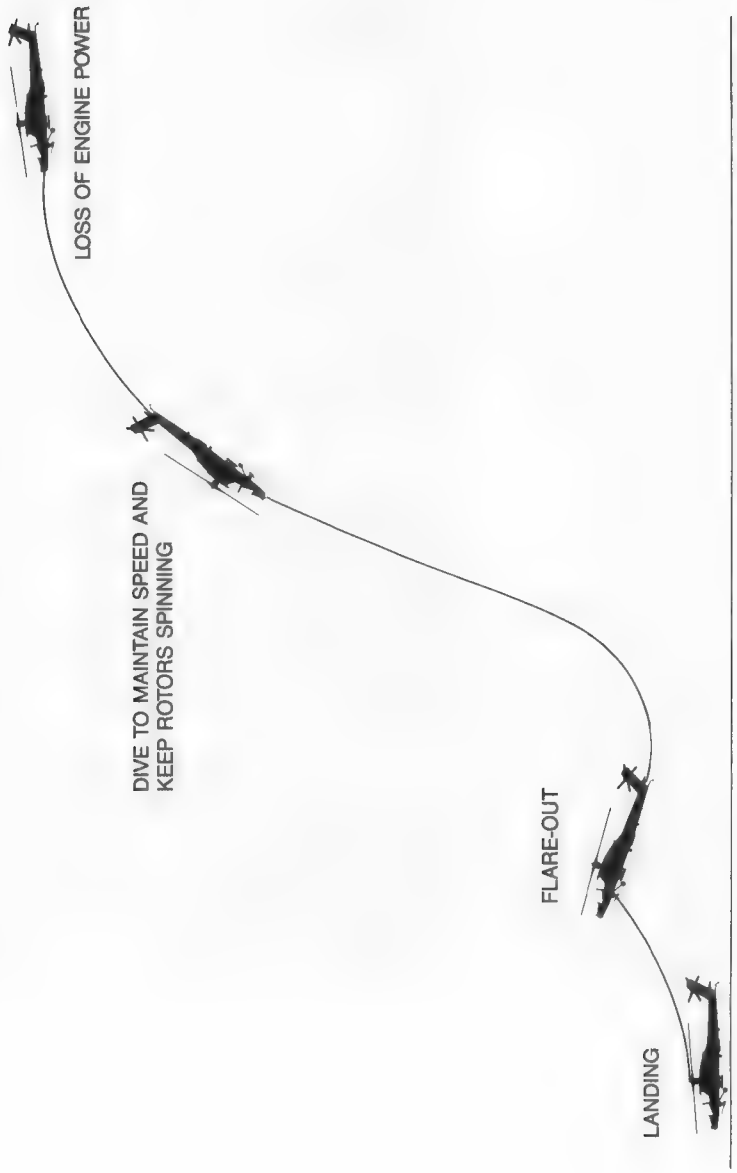


Figure 3-8. Autorotation and Power-Off Landing

A helicopter's rotors produce usable lift only when spinning. In the event of an engine failure, the blades are disengaged from the engine and are able to spin freely. With the helicopter still moving, the rotors are turned by the air moving through them, much as a toy pinwheel spins when you pull it through the air.

The aircraft is put into a steep dive to keep its speed up and the rotors turning. A lot of lift is not required at this point, so the collective is decreased to diminish drag and help the blades spin faster. When the aircraft approaches the ground, the pilot pulls back on the cyclic stick to bring the nose of the aircraft up. This is called a *flare-out.*

By creating a flare-out, the pitch of the blades is increased and some of the spinning motion of the blades is transformed into lift, slowing the fall and forward motion of the helicopter.

After the flare-out, the aircraft slows down to a hover and starts to fall. At this point, the pilot pulls up on the collective to convert the remaining spin to lift, and hopefully, lets the aircraft slowly settle onto the ground. The real key is timing the flare-out so that you do not hit the ground before you come to a hover, but yet be not so high that you run out of spin and lift before you reach the ground and end up falling like a stone.

This is by no means a complete discussion of helicopter aerodynamics. There are a number of other forces at work, but beyond this point, I start to get a little fuzzy on just how things operate. What we have covered, however, will allow you some insight as to how the aircraft stays in the air and hopefully encourage you to learn to fly *Gunship* in the Realistic Flight Mode.

Chapter 4

The Pilots

Chapter 4

Military helicopters in the U.S. are, for the most part, controlled by the Army, although the Navy and Marines do have limited helicopter operations. This is due to a compromise, called the Key West agreement, reached after WWII between the Army and the newly created Air Force. Under this agreement, the Air Force was given control of almost all of the land-based fixed-wing aircraft. The Army then followed the only path open to them in the area of aviation and pushed the development of rotary-wing aircraft (and push they have). What started out as a scout and medical-evacuation vehicle has been transformed into one of the most complex, high-tech weapons in the U.S. arsenal.

At one time, not so long ago, Army aviators took a back seat to the more colorful fighter and bomber pilots of the Air Force and Navy, but increased public knowledge of the contribution of the helicopter changed that. The high visibility of the helicopter in the Vietnam war and the increased emphasis on attack helicopters in Europe have kept the Army recruiting offices packed with applicants hoping to learn to fly at the government's expense. If, after playing with the *Gunship* simulation for while, you think that actually flying an AH-64A might not be a bad job, be prepared for a long and complicated process—but one well worth the trouble if you make it through.

So You Want to Fly the Apache

Becoming a part of Army aviation today is very hard, but not impossible. The Army is always looking for good pilots, so in order to attract as many candidates as possible, they created the Aviation Warrant Officer program.

Figure 4-1. Crew Training Briefing

What exactly is a Warrant Officer? A Warrant Officer is kind of a cross between a commissioned officer and an enlisted person. He or she is an appointed officer needed for a particular skill. The Army defines a Warrant Officer as follows: "Any officer appointed by warrant by the Secretary of the Army, based on a sound level of technical and tactical competence. The Warrant Officer is the highly specialized expert and trainer who, by gaining progressive levels of expertise and leadership, operates, maintains, administers, and manages the Army's equipment, support activities or technical systems for an entire career." The Warrant Officer program is the quickest way for someone just out of high school to get into military aviation (since a college degree is not required as is the case with pilot candidates in the other services).

So the first thing you have to do in order to fly the Apache is get into the Warrant Officer program. The program has the following requirements for application:

★ You must be a high school graduate. A GED will not do unless you have two years of college.
★ You must be at least 19 years old and not older than 30.
★ You must have perfect 20/20 vision.
★ You must be a U.S. citizen.
★ You must pass a very thorough flight physical.
★ You must pass a series of mental examinations.

If you can meet those requirements, then you get to apply for one of the slots to come open in the future. To apply, all of your personal information, a stack of references, and a handwritten letter (spelling and punctuation count) stating why you want to be an aviation Warrant Officer candidate are forwarded to the national selection board, who will vote on you. If you are not selected, you will never know why since no explanation is required. Once you pass this hurdle, you'll have to wait for a slot to come open. This sometimes takes up to ten months.

Having gone through that exhaustive process to get in, once there, you get to fly, right? Wrong. The first thing the Army will do is ship you off to Fort Jackson, South Carolina, for two months of basic training. You are a soldier first, and then a W/O candidate, so you must be taught to run, shoot, and act like a soldier.

After this grueling two months of basic, now you get to fly, right? Wrong again. Now you get to spend six weeks in the Warrant Officer Candidate Military Development Course. This is a rigorous course that teaches basic military leadership skills and professional development. During this period, the Army finds out just how badly you want to fly helicopters. You are constantly evaluated by your peers and hassled by your superiors. Weak or unmotivated candidates are weeded out before the Army wastes money teaching them to fly.

Now do you get to fly? Yes, now you finally get to fly at the Army Aviation Center in Fort Rucker, Alabama—but the pressure is by no means off. While the basic Rotary Wing Aviation Course is 36 weeks and two days long, if you do not solo in a helicopter by the fourth or fifth week, you are eliminated from flight training.

This course takes the student aviator from basic training in the TH-55 helicopter all the way to combat training, night-vision goggle qualification, and flight qualification in the UH-1H Huey or OH-58 Kiowa. A candidate leaving this school can not only fly but is able to perform the basic tasks of a new assignment.

If you're one of the top performers in flight school, you might get the chance to go on to learn to fly the AH-1 attack helicopter. Upon successful completion of this course, you'll be assigned to an Air Cavalry or Attack Helicopter unit. After spending some time there, you'll be ready to apply to fly the AH-64A Apache. The requirements are the following:

★ Be currently qualified in rotary-wing aircraft
★ Be qualified in the AH-1S
★ Have a minimum of two years as an aviator with at least one tour of duty with an air cavalry or attack helicopter unit
★ Have orders to a unit with the AH-64A
★ Have a current rotary-wing instrument rating
★ Be nap-of-the-earth qualified
★ Have a secret clearance

If you're accepted to fly the Apache, you'll go back to Fort Rucker for three more months of aircraft, classroom, and simulator training.

Well, that's all there is to it. You didn't think that they would turn just anybody loose with a $15 million piece of equipment, did you?

Chapter 5

Weapons Systems—Theirs and Ours

★ ★ ★

Chapter 5

Attack helicopters are very much like their jet fighter cousins in one regard: They are mainly a weapons-delivery platform. They're useful only because they can take a particular weapon within range of the enemy and launch it. All of the great nap-of-the-earth flying skills are important, but they won't destroy the assigned targets.

As a weapons-delivery system, the AH-64A Apache is an excellent design. In many ways, it's more of a flying tank than a conventional helicopter. It's heavily armored and carries a lot of firepower. With four weapons stations—two under each wing—the Apache can carry 5000 pounds of armaments, which is more than can be utilized in most climates.

Of course, the enemy is going to shoot back. They have developed a sophisticated system of layered antiaircraft protection which must be overcome. To defeat this system, you must understand your own weapons and those of the enemy.

AH-64A Apache Armament

Rockwell AGM-114A Hellfire missile. The Hellfire missile carries the main punch of the Apache and is a significant improvement over the TOW missile which was originally specified. The TOW is an excellent antitank weapon but has the major drawback of requiring line-of-sight contact with the target for the entire flight. The TOW is a wire-guided system that is *flown* to the target by the gunner in the helicopter. This leaves the aircraft visible and vulnerable for as long as it takes the missile to reach its target.

Figure 5-1. AH-64A Firing a Laser-Guided Hellfire Missile

The Hellfire, as proposed, was to be a fire-and-forget weapon (HELicopter FIRE-and-forget), but initial problems with the TV-based guidance system forced designers to consider a laser-tracking system. This system does not provide true fire-and-forget operation but requires that the target be illuminated by a laser for the last portion of its flight.

The important difference between the Hellfire and the TOW is that the laser used to guide the Hellfire does not have to be on the helicopter. Since the Apache can aim at and deliver Hellfire missiles to a target which is illuminated by ground-based or scout helicopter–based lasers, it can hit a target the gunner never sees.

Figure 5-2. Loaded Apaches Ready for Action

A mast-mounted sight has been developed for just this purpose. This device sits on top of the rotor mast and allows an OH-58 scout helicopter to illuminate targets while hiding behind trees or rocks. The Apache can also fire the Hellfire before the target is in view, by using the lock-on-after-launch mode.

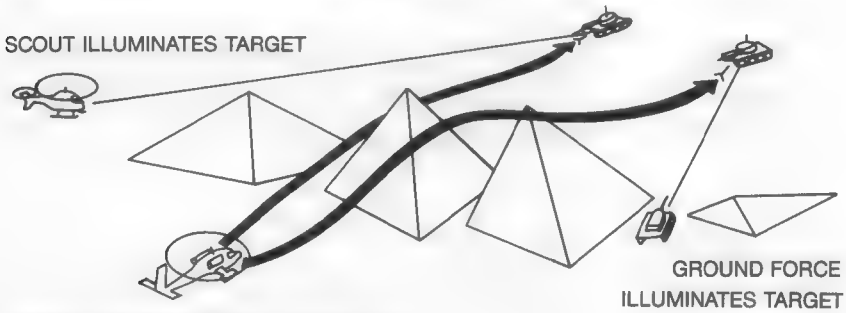
Figure 5-3. U.S. Army/Rockwell Hellfire Missile

To do this, the gunner launches the missile, and then, several seconds later, the pilot pops up from concealment and illuminates the target for the last few seconds of the flight. This is generally enough time for the missile to lock-on to the target and change course.

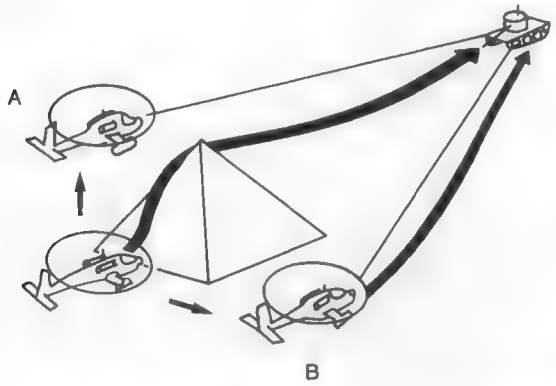
The whole idea of the Hellfire is to reduce the vulnerability of the aircraft delivering the weapon. The remote designation and lock-on-after-launch capabilities combined with a longer range make the Hellfire a much safer weapon to use than the TOW.

The M230 chain gun. The chain gun, or area weapon, was designed specifically for the Apache. When Hughes Aircraft won the contract to build the AH-64A in December 1976, they were also awarded the contract to produce a gun of a totally new design. Instead of using a multibarrel Gatling-style gun as had been the practice, they used the Lanier

Figure 5-4. Hellfire Missile Remote Fire Options (Top); Hellfire Missile Direct Autonomous Fire Options (Bottom)

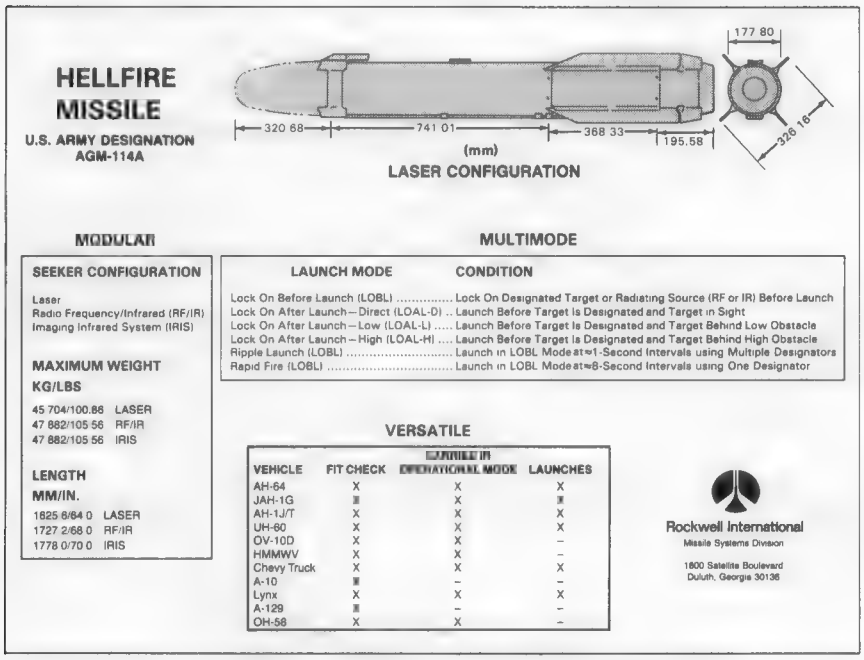


LOCK-ON AFTER FIRE
APACHE FIRES FROM BEHIND HILL THEN POPS UP TO ILLUMINATE TARGET



DIRECT FIRE
APACHE UNMASKS LATERALLY, ILLUMINATES TARGET AND FIRES

Figure 5-5. Hellfire Missile Specifications



Linkless Feed System to load the ammunition into a unique rotating-bolt mechanism. This mechanism is chain driven, as opposed to the old method of using the gas created by firing a round to eject the cartridge and recock the gun. That system was prone to jamming if the round did not fire to create the gas. With the chain-drive system, the round gets ejected after the firing cycle whether it fires or not.

The gun is a 30mm weapon instead of a 20mm gun like the one on the AH-1 Cobra. The increase in size gives the Apache more firing range and killing power against armored targets. Another difference between the Cobra and the Apache is the location of the ammo magazine. In the Cobra, the gun and the ammo were located on the chin of the aircraft under the gunner's station. As the fuel burned and rounds were expended, the weight distribution of the air-

craft constantly changed, negatively affecting the flight of the helicopter. To avoid this problem, the ammunition aboard the Apache is stored near the center of gravity in the belly of the aircraft directly under the rotor mast.

Although the 30mm gun is capable of destroying armored targets, the main purpose of the area weapon is to provide suppressive ground fire while the crew carries out their antitank mission. The gun is usually operated by the CPG, but it can be operated by either crew member using the *look-and-shoot* helmet-mounted sight system.

Aerial Rockets. Folded Fin Aerial Rockets (FFARs) are included in the Apache's arms list as a complement to the short-range gun and the long-range Hellfires. Although these rockets may appear small, they are actually five and a half feet long and carry quite a punch. These unguided rockets were deployed in Korea in an air-to-air role on board F-86 fighters and were among the first arms to be used aboard helicopters in Vietnam. There they proved to be cheap and effective and made the transition from use aboard the UH-1 Huey to the AH-1 Cobra, the first true attack helicopter. Now they've made another transition to the new generation of attack helicopters, the modernized AH-1S and the AH-64A Apache.

The role of the 2.75 FFAR aboard the Apache is similar to that of the 30mm area weapon. It is used to suppress ground fire in an area about to be entered, and, since it has a longer range, it can be used to keep the enemy's head down until the 30mm gun can be employed. The rocket can also be used to attack and destroy soft ground targets which are not vulnerable to Hellfire attack, such as depots and antiaircraft (AA) gun sites. In emergency situations, it can even be used in an air-to-air role against Hind helicopters.

The FFARs have been constantly improved over the years (a trend that is continuing). New versions are said to contain a submunition warhead. These warheads will disperse a number of M73 grenades, or *bomblets,* which can defeat prone personnel and light armor over a wide area.

Air-to-Air Weapons. The choice of an appropriate air-to-air missile for the Apache is currently the source of great debate and interservice territorial bickering.

The AIM-9L Sidewinder is by all accounts the best short-range air-to-air missile in the world today. It has been used effectively in 1981 by the U.S. Navy against Libyan fighters, in 1982 by the Israeli Air Force against Syrian jets, and most recently in the Falkland Islands where the British shot down 16 Argentine fighters with *niner limas,* as they are called.

The Sidewinder was developed by the Air Force however, not the Army, and, in a typical case of interservice shortsightedness, the Army wants to use a weapon developed within their own service. The weapon they have chosen is the FIM-92 Stinger missile. The Stinger was developed by the Army as a shoulder-fired ground-to-air weapon and, as such, is much smaller than the Sidewinder. Due to this size difference, the Stinger is not nearly as lethal as its Air Force counterpart. This is a major consideration since the large and heavily armored Mi-24 Hind and Mi-28 Havoc are the most likely opponents to be encountered over the battlefield in Europe. The main advantage of the Stinger is that, due to its small size, a launcher box containing two missiles can be mounted on each wing. But, if it takes two hits from a Stinger to bring down a Hind, then little is to be gained.

The designers of *Gunship* have included the AIM-9L as the air-to-air weapon for the Apache, and I think that if the helicopter were to go into combat, the pilots and gunners would insist on carrying the Sidewinder. Using what makes the generals happy during training is one thing, but it is quite another to go into battle and risk your life with an inferior weapon.

Weapons mix. Of course, the Apache crews would love to carry 16 Hellfires, 38 FFARs, and a couple of air-to-air missiles along with a full magazine of 30mm ammo. The Apache, unfortunately, cannot carry everything, and in some weather conditions loads must be further reduced. The following is a list of Army-recommended arms to be carried for various missions in differing climates.

Type of Mission	Temperature	Weapons
Antiarmor Mission (Middle East)	95 degrees	8 Hellfires, 1200 rounds 30mm
Antiarmor Mission (Europe)	70 degrees	16 Hellfires, 1000 rounds 30mm
Covering Force (Europe)	70 degrees	4 Hellfires, 38 rockets, 320 rounds
Airmobile Escort (Middle East)	95 degrees	38 rockets, 1200 rounds
Airmobile Escort (Europe)	70 degrees	76 rockets, 1200 rounds 30mm

This list is only a suggestion. Each mission will have different requirements. The important thing to notice is that operating in hot weather will reduce the aircraft's lift ability and reduce the amount of arms you can carry. Overloading the aircraft for the current weather conditions is a dangerous practice—since the loss of one engine could force you to land in enemy territory or to dump valuable weapons.

Soviet Weapons

Air Defense Systems. The Soviet doctrine regarding air defense is no secret. They are expected to adhere strongly to the four basic principles of antiaircraft coverage: mass, mix, mobility, and integration.

★ *Mass.* The Soviets will bring to bear as many weapons as possible in the air defense (AD) role. This will include an enormous amount of small-arms fire. The greater the number of projectiles that can be thrown at an aircraft, the greater the probability that a hit will be scored. At the least, the crew will be distracted and may abort the mission.

★ *Mix.* Every AD system has its limitations and vulnerabilities. When AA guns and missiles are employed together, the limitations of each are offset by the other. Countermeasures used to defeat one system will rarely fool the other.

★ *Mobility.* Mobility serves two functions for an AD system. First, as the force moves forward with the advancing battle, the AD systems can move with them. Secondly, air defense systems which remain in the same position for extended periods of time are subject to being located by the enemy and targeted for destruction. A constantly moving target is much harder to pinpoint and eliminate.

★ *Integration.* Integration can be achieved by locating the AD systems throughout the area to be defended, from the front lines to the rear areas, thus providing defense in depth.

The Syrian and Egyptian forces learned a harsh lesson in these four principles during the Six Day War of 1967. Prior to the war, their entire AD system consisted of 150 SA-2 missiles and a number of 57mm AA guns. All of these weapons were located in fixed sites. With the outbreak of the war, the Israelis launched a strike against the enemy airfields and AA sites. In one attack, they destroyed 380 of the Arabs' 500 aircraft and 60 percent of the Arab ground forces.

Upon examination, it is clear that the Arabs did not follow even one of the four principles of air defense: With very few weapons, mass was not achieved; only two weapons do not make for a proper mix; the units were certainly not mobile; and with all of the AD located in a single belt, there was no defense in depth. When war broke out again in 1973, the Arab forces were much better equipped and trained.

Air Defense Weapons. Soviet antiaircraft firepower includes a variety of mobile guns, missiles, and the Hind helicopter.

SA-7 and SA-14 Grail. The Grail is a man-portable, shoulder-fired, heat-seeking, surface-to-air missile. The operator points the missile in the direction of the target, applies half-trigger, and observes the internal light. When this light turns from red to green it is locked onto the target. Full trigger is then applied, and the missile is fired.

Like U.S. Army shoulder-fired missiles, the SA-7 and the SA-14 have a short-burn boost stage which burns out before the missile leaves the tube. Once the missile is a safe distance from the operator, the main engine ignites and powers the missile to the target.

The missile itself uses passive infrared (IR) homing guidance. It is attracted to the heat produced by your aircraft. The basic SA-7 has an unsophisticated tracking system that is easily fooled by flares. The SA-7B has an improved guidance system with an IR filter to screen out these decoys. The new

SA-14 has an even better guidance system and is reported to contain a larger warhead.

Warhead size has always been the main weakness of the SA-7 series. Due to its small size, even direct target hits were not always fatal. During the Yom Kippur Middle East war, over half of the Israeli A-4s hit by SA-7s were able to safely return to base.

These missiles will be found throughout the Soviet-controlled areas. They will move forward with infantry and

Figure 5-6. Soviet SA-7 Hand-Held SAM

motorized rifle divisions equipped with BMPs (Boevaya Mashina Peknota, a type of infantry fighting vehicle). They are also used against low-flying aircraft as a close-in defense weapon around rear headquarters and supply areas. It's likely that you'll encounter SA-7s and/or SA-14s at numerous locations during your missions.

ZSU-23-4 Shilka. The second line of air defense follows closely behind the fast-moving infantry and BMPs. This line consists of the much feared ZSU-23-4 Shilka mobile AA gun. The Shilka, or *zoo* as U.S. soldiers call it, is a rapid-firing AA cannon with four liquid-cooled 23mm barrels. The system is aimed via computerized radar fire control and is mounted on the PT-76 light-tank chassis.

The reported practical rate of fire is 200 rounds per minute per barrel, fired in 50-round bursts. They can also fire while on the move. The main weakness of the system is the relatively light armor on the turret; the thin armor plating can be penetrated by machine gun fire. Zoos are usually employed in pairs located fairly close together (200–400 meters).

SA-9 Gaskin Missile. In the same general area as the ZSU-23-4, you might also find SA-9 missiles. They would normally be located a kilometer or so behind the zoos to provide forward and rear area coverage. The SA-9 system consists of a light-armored vehicle (wheeled—not tracked and not amphibious) to which four SA-9 launchers are attached on a rotating mount. The SA-9 missile is very similar to the shoulder-fired SA-7. They are heat-seeking with a small warhead, though the SA-9 does have a longer range than the SA-7. Since there is no onboard fire control with the SA-9, the target must be visually acquired by the operator.

SA-8 Gecko Missile. In forward and rear areas of well-equipped, front-line Soviet and Soviet-backed forces, you will also run into SA-8 missiles. The SA-8 system uses a six-wheeled light-armored vehicle to carry a quad launcher for the SA-8 missiles. This system features multiple tracking methods. The main system consists of a large tracking radar for locating targets and two missile guidance radars which

Figure 5-7. Soviet ZSU-23-4 Mobile Antiaircraft Gun

can operate independently. This allows two missiles to be fired at once. Once close to the target, the radar control hands off to an IR-seeking system for final maneuvering. If both of those systems are fooled, it also has an onboard visual TV-guidance system. Besides the four missiles carried in the launchers, it's believed that they also carry eight more missiles internally, enough for two complete reloads. As these weapons become more available, it's likely that they'll replace the S-60 AA gun in the rear-area air defense role.

SA-11 Gadfly Missile. First-line Soviet troops will likely also have the SA-11 system as a backstop behind the forward lines. The missile itself is very similar to the older SA-6. The problem with the SA-6 was that all the vehicle launchers were tied to a single radar controller. The SA-11 system allows each TELAR (Transporter Erector Launcher And Radar) to act independently by fitting each with its own radar system. Since this system no longer needs to be bunched together,

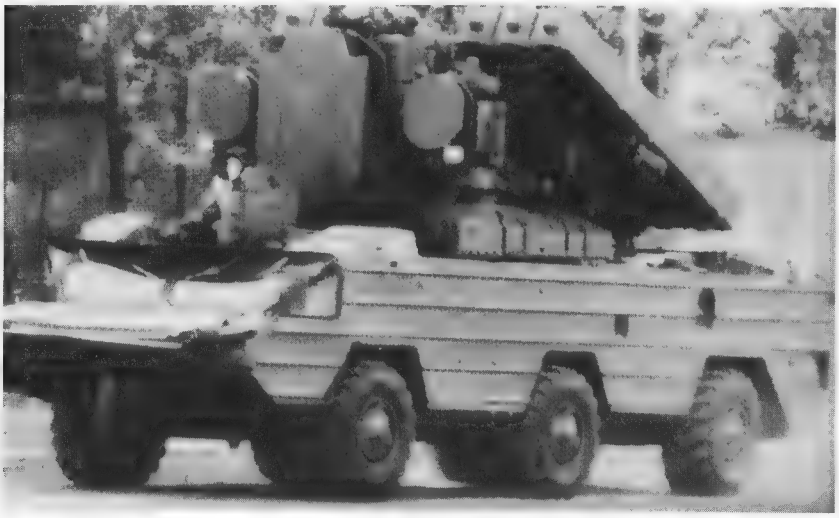
Figure 5-8. Soviet SA-9 SAM

this weapon may show up in all areas of the battlefield.

SA-13 Gopher Missile. Another weapon likely to be found only with first-line troops is the SA-13. This missile is basically a new and improved version of the SA-9. The Gopher sports a new cryogenically cooled IR seeker which makes it the most sensitive heat-seeking weapon in the Soviet arsenal. This device also operates in two frequency bands, making it much less susceptible to countermeasures. The SA-13s are mounted on a modified MT-LB tracked chassis which gives them much-improved mobility over the SA-9s they were designed to replace. This chassis gives the system cross-country maneuverability comparable to the BMP-equipped motorized rifle groups they are supposed to protect.

S-60 Towed AA Gun. The S-60 is an old but effective 57mm rear-area Air Defense weapon. This gun is generally aimed and fired optically, but more modern versions featuring long-range search radar and radar fire control are available to better-equipped forces.

Figure 5-9. Soviet SA-8 SAM



Mi-24 Hind Helicopter. The use of the helicopter as an air defense weapon is a fairly recent development and is still undergoing constant change. Currently, the aircraft most likely to be faced by U.S. pilots is the multipurpose Mi-24 Hind, although plans are thought to be underway for a pure fighter helicopter more suited for the air-to-air role.

The Hind is powered by two turbo-shaft engines, each of which produce 2200 horsepower and are armor protected. This power enables the Hind to carry 3330 pounds of fuel, 3200 pounds of arms, and a ton of armor at speeds close to 200 mph. The sheer size of the Hind is its main liability. It's easier to spot at a distance than the narrower and smaller U.S. attack helicopters and not nearly as maneuverable. The Soviets counter this problem by producing large numbers of these aircraft (as many as 1500 may have been built) and by constantly improving their tactics.

Figure 5-10. Soviet Hind Helicopter

Chapter 6

Basic Helicopter Flight Training

Chapter 6

The *Gunship* game allows for two levels of realism in the manner in which the aircraft responds during flight. The Easy Flight Mode offers little in the way of realistic helicopter flight. Operation in this mode is rather like flying an airplane which is stuck at one altitude. Turning, increasing, and/or decreasing the aircraft pitch has no effect on gaining or losing altitude. This mode is fine for beginners who are in a hurry to get up and flying, but after you're acquainted with the program and its capabilities, the Realistic Flight Mode should offer a continuing challenge.

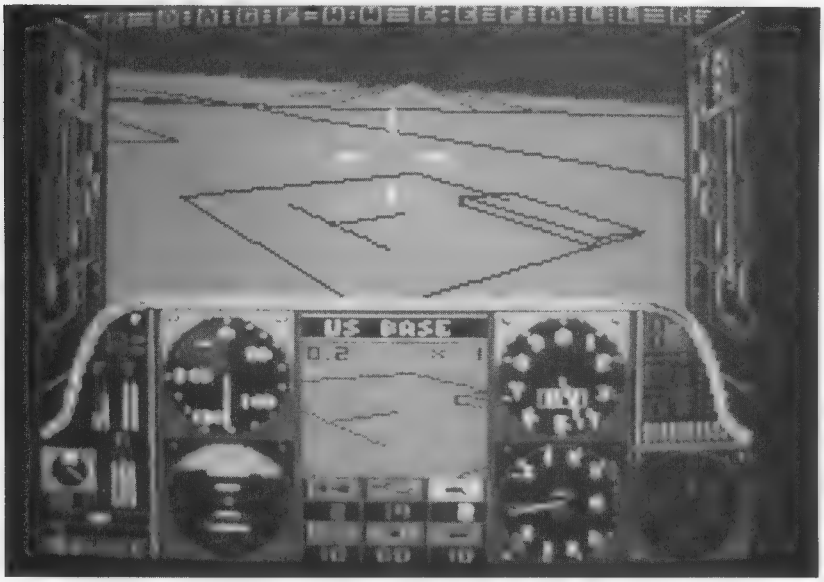
The rest of this chapter is geared toward teaching you to fly the aircraft confidently in the Realistic Flight Mode. Each tutorial that follows is designed to teach a particular flying skill that you'll need to be successful and survive on the battlefield. Each tutorial also builds on the previous lesson, so they should be taken in order.

Set aside the time to master each lesson before moving on to the next. The whole idea is to drill and practice these flying skills until they're second nature. Doing so will allow you to concentrate on your mission and the enemy's weapons once you get into battle.

To begin a Basic Training session, choose the following selections on the computer menus:

★ Duty Assignment: Flight Training in the U.S.A.
★ Style: Regular Missions
★ Reality Selections: Realistic Flight
Easy Landings
Easy Weather
1st Line Enemy

Figure 6-1. Coming in for a Landing at a U.S. Base



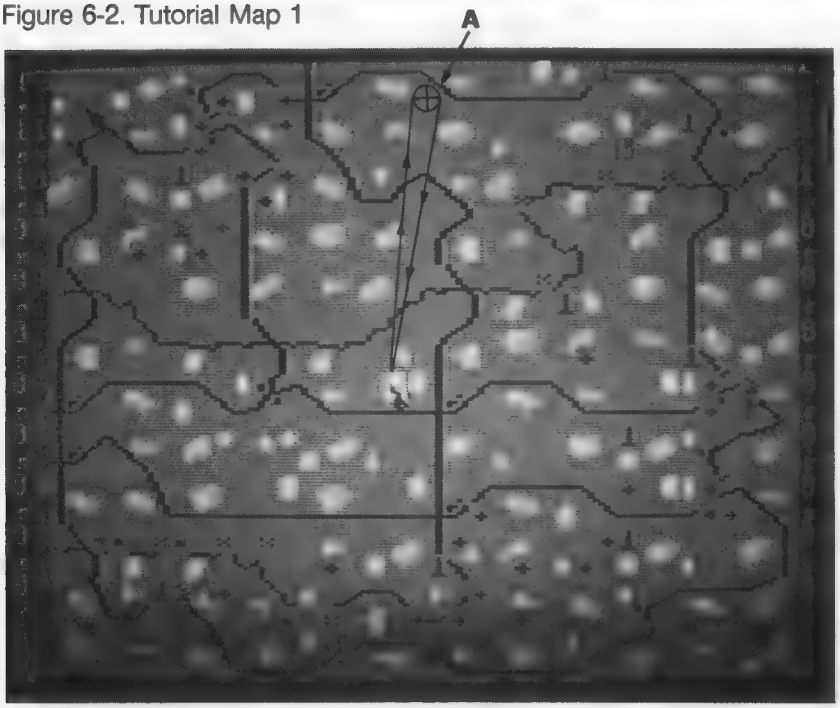
Tutorial 1: Takeoff and Level Flight

The purpose of this lesson is to help you gain confidence in your ability to get the aircraft off the ground, into level flight, and back on the ground again. When the cockpit screen comes up, go to the map screen and move the cursor to position A as shown on Tutorial Map 1.

★ Once the cursor is in place, return to the cockpit screen. Now start both engines and press the key to engage the rotor. Now find the Torque Gauge.

While observing this gauge, start pressing the Up Fast collective key until this gauge is 80 percent of maximum. Once this point is reached, hit the Up Slow key until the aircraft starts to rise. The aircraft should stop rising at 12 feet. If it continues to rise, press Down Slow until you have the aircraft stabilized at 12 feet.

Figure 6-2. Tutorial Map 1



Locate the VSI (Vertical Speed Indicator). This gauge is very important when flying in the realistic mode. As you start to rise, the needle points slightly upward; as you descend, it points downward. Since you are hovering, it should be level.

★ Now that you are up and hovering, you need to get moving forward. Press forward slightly on the stick. You should start moving forward. Note that the Airspeed Indicator now shows a couple of knots of airspeed. Press forward on the stick again and you should see a further gain in airspeed. Gaining forward speed is a gradual process and should not be rushed—or you will lose lift and crash. Repeat this process of applying forward stick until your airspeed reaches 30–40 knots. At this point, without your touching the collective, you will start to gain altitude. This is due to the addition of Translational Lift.

★ Increase your speed further by applying more forward stick. Do this a little at a time and note that as you go faster and faster you stop going up. At 100–120 knots, you should be able to get the VSI needle level again indicating that you are in level flight.

★ One of the most important things you can learn is the ability to control your altitude by using the stick instead of the collective buttons. Continue to fly forward toward the INS cursor and use the stick to maintain an altitude of 200 feet. If you are higher than that, push forward on the stick slightly until the VSI tells you that you're descending. When you reach 200 feet, pull back on the stick until the VSI needle is level. Don't overcontrol. After moving the stick, wait a second and see the effect on the VSI.

★ By now, you're probably close to or past the INS cursor. Go to the map screen, reposition the cursor over the base in the center of the map, and return to the cockpit screen. You'll notice now that the INS indicator is off to one side of the scale.

★ Another important skill to learn is the transition from forward flight back to a hover. To do this, pull back on the stick, watching the Airspeed indicator, until you reach an airspeed of 0 (the needle should be straight up). Note that during the time it took to stop, you gained a good bit of altitude. Later you'll learn how to prevent this. Once your speed reaches 0, you should be hovering or descending slightly. Use the Rotate Right button to spin the aircraft until you're lined up with the INS cursor.

Return to forward flight by pressing forward on the stick. As you reach cruising speed (100–120 knots), try to lose your excess altitude and return to 200 feet. Maintain level flight there.

★ Locate the base with the TADS system and note the distance. When you get to two kilometers, press forward on the stick to reduce your altitude. Level off at 100 feet.

★ As you pass 0.5 kilometer, press the Down Fast button twice and immediately pull back hard on the stick. As you

come to a stop and hover, press the Up Fast key twice to replace the collective you removed earlier. You should now be about 0.2–0.3 kilometer from the base. Adjust the collective so that you're going down slightly.

★ Move forward slowly toward the base and continue to reduce your altitude slightly using the collective. (Using the stick at this point would cause your speed to increase, and you'd overshoot the field.)

★ When you reach an altitude of 12 feet, you should stop descending automatically, due to the ground-cushion effect. Now move on to the base until the TADS indicates a distance of 0.0 kilometer. Stop, hover, and hit the Down Fast key once to get the aircraft on the ground.

Repeat this procedure until you can go smoothly from a hover to forward flight and back to a hover, and land in a precise and controlled manner. Once you've accomplished this, you're well on your way to becoming an ace *Gunship* pilot!

Tutorial 2: Turning

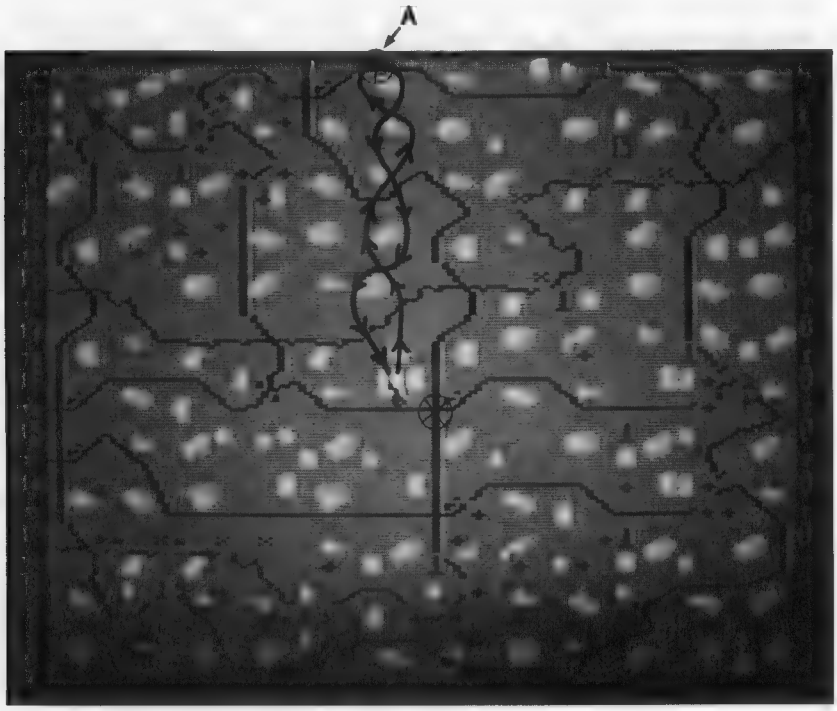
Set your INS cursor to position A on the map (Figure 6-3).

★ Take off and line up the INS indicators. Maintain level flight at 100 feet at a speed of 100 knots. Note that at 100 feet you're below the tops of the hills, so you'll have to maneuver to avoid them.

★ Let the first hill pass by on your left and then push the stick slightly to the left to put the aircraft into a shallow turn. If you start to lose altitude during the turn, you're turning too steeply. Apply a little right stick to compensate. You should be able to make gentle turns without losing altitude.

★ Once you pass to the left of the second hill, reverse the turn and bank the aircraft gently to the right. Continue using gentle turns to weave in and out of the hills as shown on the Tutorial Map 2. If at any time you get lost or confused as to which hill you should be heading toward, simply refer to Figure 6-3 and the CTR display.

Figure 6-3. Tutorial Map 2



★ When you pass over the second road, you're nearing the edge of the area. Go to the map screen and place the cursor over the base in the center of the map.
★ To get turned around, you're going to perform a steep turn. Steep turns will cause you to lose altitude, so as you start the turn, pull the stick back a little to compensate. Now push the stick hard to the right. Keep an eye on your altitude and the INS cursor. When you're heading in the same direction as the cursor, apply hard left stick to pull out of the turn and apply enough forward stick to stop gaining altitude (compensating for the pitch up you applied before the turn). Maintain an altitude of 100 feet and a speed of 100 knots.
★ On your way back to the base, you can weave between the hills again but this time practice using steep hard turns.

Don't forget to pitch up when entering the turn and to pitch down when leaving the turn to maintain your altitude.

★ Make a nice smooth landing at the base.

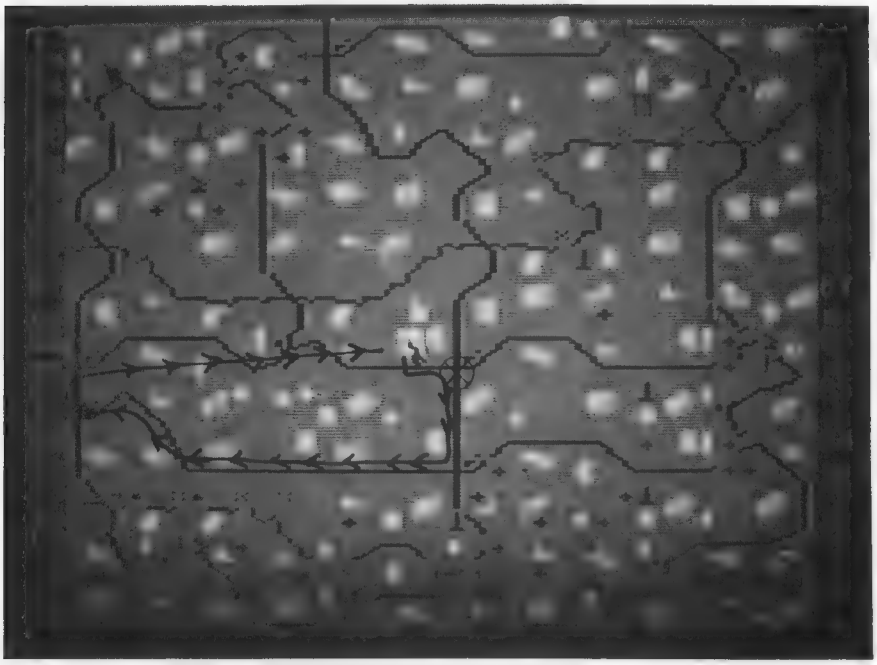
Practicing this lesson will show you how to maneuver the aircraft in the Realistic Flight Mode. It also reinforces the concept of controlling your altitude with the cyclic stick and keeping your hands off the collective except when absolutely necessary.

Tutorial 3: Low and Slow/High and Fast

The purpose of this lesson is to familiarize yourself with the various speed capabilities of your aircraft. To accomplish this, we'll do some IFR flying. (No, not Instrument Flight Rules, but the IFR flying real helicopter pilots use—I Follow Roads.)

Set your INS cursor over the crossroads indicated on the map.

Figure 6-4. Tutorial Map 3



★ Take off, head for the INS cursor, and make your speed 50–60 knots. At this speed, you'll continue to gain altitude unless you adjust the collective. One press on the Down Fast key should put you in level flight. Make your altitude 100 feet.

★ When you come to the crossroads, turn right and follow the road south. Maintain your speed at 60 knots and try to make your altitude 60–80 feet using the collective. When adjusting the collective at low altitude, it's best to use the Slow Up and Slow Down keys until you're familiar with the aircraft.

★ Continue to follow the roads using the course indicated on Tutorial Map 3. Attempt to maintain 60 feet at 60 knots. You may have to constantly adjust the collective as level flight at this altitude is difficult. It may be necessary to drift up to 70 feet and adjust the collective down a little and then drift down to 50 feet and adjust it up and repeat the process.

★ Once you reach the hut at the third crossroads, you'll be getting low on fuel. Set the INS cursor back over the base. Hit the Up Fast key once and turn toward the base while gaining altitude. When you reach 200 feet, pitch the nose down to pick up speed and get into level flight. Once in level flight, pitch the nose down slightly. Note that you'll start to lose altitude but gain speed. Now hit the Up Slow collective key until you're back in level flight, now at a higher speed. Repeat this process until you're in level flight at 150 knots. This is about the maximum speed for your aircraft with a full weapons load. If you fire or jettison your weapons, you can fly a little faster.

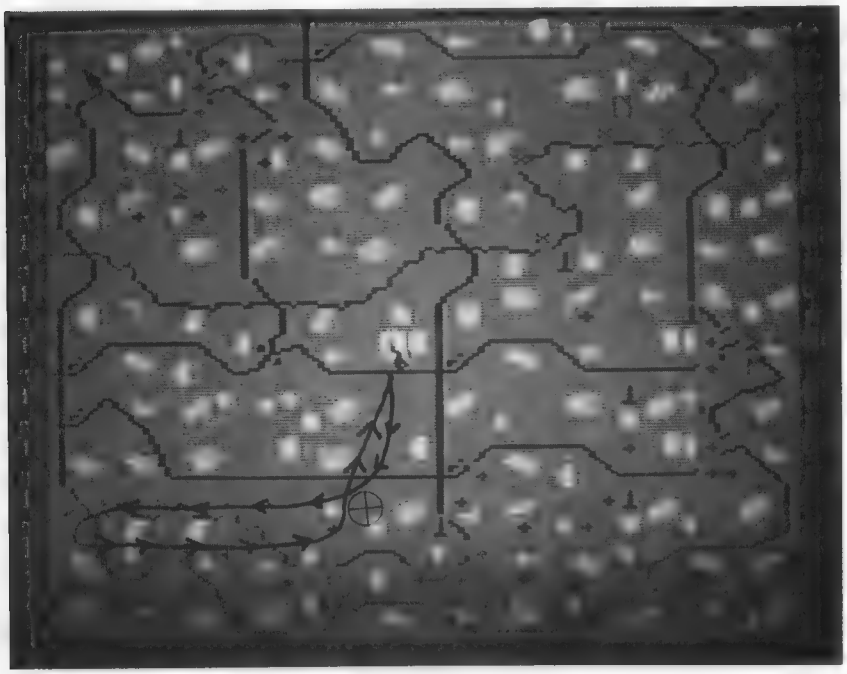
★ Once the base comes into sight, slow down to 100 knots and land as usual.

Tutorial 4: Gun Practice

Almost all of the targets in the game are vulnerable to fire from the chain gun, with the exception of an occasional bunker. By following this tutorial, you'll learn to engage targets effectively with the gun. You'll also learn that doing so can be extremely dangerous.

Set the INS to match the position on the map.

Figure 6-5. Tutorial Map 4



★ Take off and fly toward the INS cursor and then turn toward your targets. Fly at a speed of 100 knots at an altitude of 100 feet. By attacking in this manner, you'll have a number of targets lined up in a row so you can deal with them one at a time.

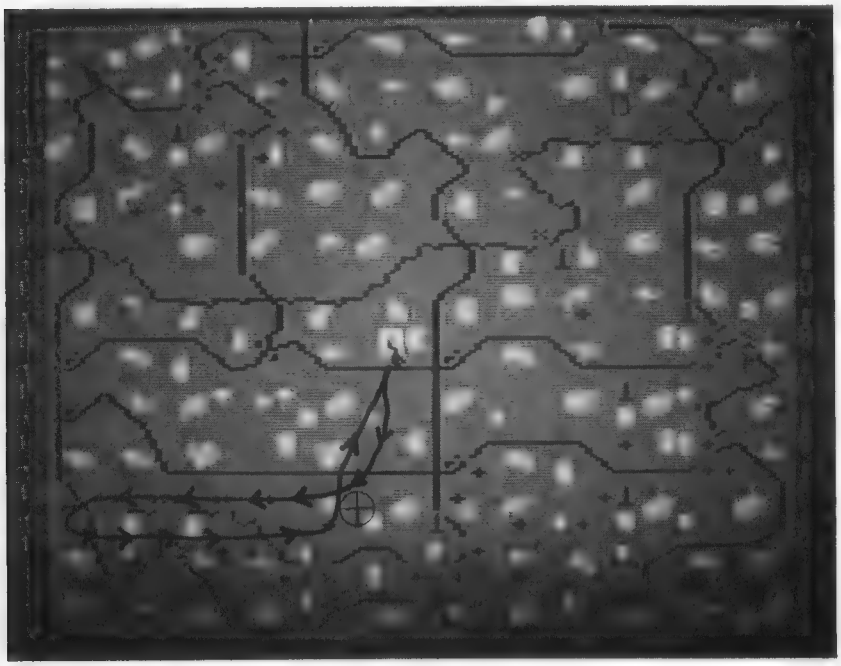
★ Follow the basic flight plan on the map but zigzag back and forth as necessary to line up the targets. (It isn't necessary to point the crosshairs directly at the target, but the gun is more accurate when the target is near the center of the screen.) Wait to fire until the target is 0.7 kilometer or closer. (Waiting until it is 0.3 kilometer will guarantee a hit on the first shot.) If a target is off to one side, you can switch to the Left or Right View before the target is off of the front screen, and the TADS system will continue to track it. Pick a target and destroy it in this manner with the gun. As you start to fire, you'll notice that the gun causes the nose to pitch up, so you'll have to correct constantly by applying forward stick to prevent the aircraft from gaining too much altitude.
★ As you get into the enemy area, you'll start to take hits from enemy weapons. Activate the jammers and watch many of the missiles pass right by you. Enemy fire is the main problem with using the gun. Getting close enough to use your gun also puts you in range of a number of enemy locations.
★ When you finish the second leg of your attack, set the INS back over the base and head for home.

Tutorial 5: Combined Gun and Rocket Attack

By using a combination of guns and rockets, you'll be able to hit targets further away—before they can get ready to attack you.

★ You'll attack the same group of soft and hard targets that, in the last exercise, you hit with the gun only. This time, use rockets for the soft targets (infantry) and use the gun on hard targets (BMPs, bunkers, and SAMs). Putting a couple of rockets near these hard targets may suppress them enough to let you get within gun range before they fire a shot.
★ Follow the attack plan as shown on the map, switching back and forth between guns and rockets as the targets require. By using this technique and the jammers, you should receive fewer enemy hits than you did using the gun alone.

Figure 6-6. Tutorial Map 5



★ Once all of the targets are destroyed, set the INS for the base and return home.

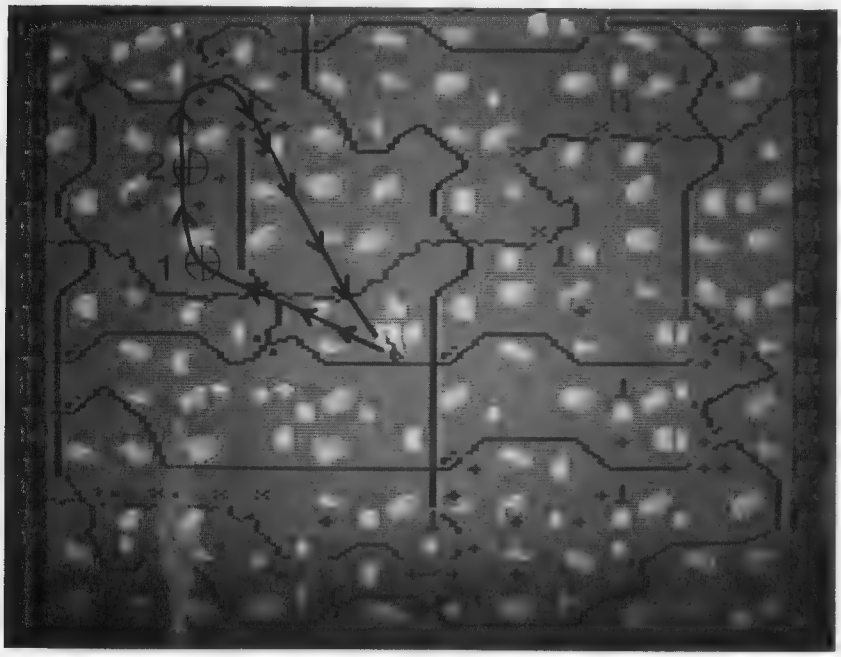
Tutorial 6: Hellfire Missiles

This time, you're going out *loaded for bear*. Using the Hellfire Missile is the safest way to engage an enemy target, because it has the longest range and allows you to attack from further away. All of the targets in the area you're headed for are vulnerable to Hellfire Missiles.

★ Set your INS to match the location on the map marked position 1. Take off and fly toward the INS location at 100 knots and 100 feet.

★ As you pass over the river, set the INS to position 2, turn toward the INS cursor, and come to a hover at 200 feet. Use the tail rotor to turn right and left to see if any targets in the area are visible. If targets are available fire away with a Hellfire!

Figure 6-7. Tutorial Map 6



★ If no targets are visible, apply a little forward stick to begin moving ahead slowly. When the targets start to show up, try to locate the ZSU-23-4 AA gun and take it out first since it is the most dangerous piece of equipment in the area.
★ Once you've removed the *zoo*, slowly continue on to the north and take out the SA-9 next. Now you can hit the rest of the targets at your leisure with only SA-7s on some of the BTR armored personnel carriers to worry about.
★ When you get a tank or BTR targeted, use the Next TADS Target key to see if there is another target close by. If there is, you have a ripple-fire opportunity. Fire a Hellfire at the first target, then wait a couple of seconds, and fire a second missile behind it. When the first missile hits and destroys the first target, the TADS will automatically jump to the next target. If you have timed it right,

the second missile will turn and hit the second target. By using this technique, you can engage and destroy more targets in less time, giving the enemy less time to react and shoot back.

★ Take out all of the targets in the area. If a target pops up within 0.7 kilometer, you are probably too close to use a Hellfire, so switch to the gun and lay down some 30 mike-mike!

★ Once all of the targets are gone, return to the base at 100 feet.

Tutorial 7: Air-to-Air Combat

The Soviet Hind helicopters will be a continuing thorn in your side as you progress to more difficult missions. Learning to use your Sidewinder missiles is a must.

★ Since you never know exactly when the Hind will appear, you should start this training mission with weapons practice. Pick a section of the map, make an attack plan, and start your attack.

★ At some point during your attack, you'll get a message saying a Hind is airborne. The Soviet helicopter will be coming from the enemy base in the upper right corner of the map (don't destroy this base or you won't have any Hinds to practice against).

★ When the blinking dot appears on your threat display, indicating the location of the Hind, you'll have to break off your attack and deal with it. Turn toward the enemy, arm a Sidewinder, and shoot at your first opportunity. If you're sure that the Hind is in front of you and not behind a hill, you can lock onto any ground target to arm your weapons and fire a Sidewinder. It will home in on the helicopter without the TADS system.

★ Once you've destroyed the helicopter, you can go back to your attack; another enemy helicopter will be along shortly, though, so be alert. After you take care of the second Hind, finish your attack and return to the base.

Tutorial 8: Autorotation

The term *autorotation* is often used to mean both the act of autorotating to maintain flight and the performance of a power-off landing. Above 100 feet, you're autorotating, or using the forward speed of the aircraft to keep the rotor spinning to provide lift without the help of the engines. Once you're below 100 feet, you shift from autorotation to power-off landing procedures. If you lose both engines below 100 feet, you can forget about autorotation and concentrate on landing in one piece.

Student pilots in the Army have this skill constantly drilled. They know that the IP (Instructor Pilot) is likely to shut down the engines at any time and any altitude and that they must react quickly and instinctively to maintain control of the aircraft.

★ Take off heading north and then level off at 300 feet and 100 knots. Point the aircraft toward an area with no hills. Jettison your Hellfires. Normally, by the time you sustain enough damage to have to autorotate, you'll have fired a number of your weapons.
★ To simulate losing both engines, hit the Rotor Disengage key. (If you lose both engines while flying a mission, the first thing you should do is to disengage the rotor so it will spin freely.) You'll start to fall like a rock! Pull back on the stick until you have an airspeed of about 70–80 knots. Don't worry about how fast you are falling, just maintain your airspeed.
★ When you get below 100 feet (it won't take long) pull back hard on the stick to pitch the nose up and slow your forward speed; at the same time, start hitting the Up Fast key to get as much lift as possible before you hit the ground. If you time it right, you'll come to a hover at 10 or 20 feet and settle slowly to the ground.
★ Reengage the rotor, take off, and repeat the process until you're comfortable with the procedure—starting at 300, 200, and 100 feet.

★ When you have practiced the procedure several times, restart the program and change your reality level to Real Landings. Now try the above lesson again knowing that if you land too hard you'll crack up your ship.

If you can master the skill of landing with no power, you have greatly increased your chances of living through some very tough missions. Even the best *Gunship* pilots occasionally get shot down, so take time to practice this skill, and you'll walk away from a pretty badly damaged aircraft to fly another day.

Chapter 7

Attack Helicopter Basics: Ten Rules to Live By

Chapter 7

★ ★ ★

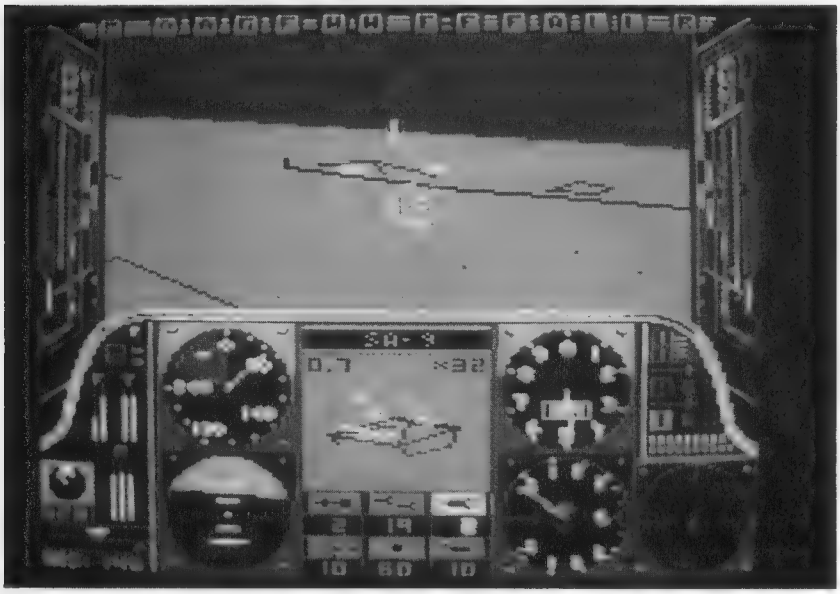
By direction of the President of the United States, under the provisions of an act of Congress, the Distinguished Service Cross is awarded to Warrant Officer Buzzsaw for extraordinary heroism in connection with military operations involving an armed Soviet force near the East German border. While serving as an Attack Helicopter Commander, Warrant Officer Buzzsaw demonstrated decisive leadership, fortitude, and professional skill while participating in an antiaircraft suppression mission in support of an Air Cavalry unit.

Warrant Officer Buzzsaw's mission involved the destruction of a certain ground-based mobile antiaircraft installation. As W.O. Buzzsaw crested the top of a hill, he was taken under fire by the object of his mission. He proceeded on towards the target to make a high-speed rocket and gun attack. As he pressed on to the target, W.O. Buzzsaw exhibited superior flying skills by weaving and jinking to avoid the withering enemy antiaircraft fire. When only 500 meters from the target, his aircraft was hit by a series of SA-7 missiles fired by a nearby infantry unit. Although his aircraft was severely damaged, and he was desperately wounded, W.O. Buzzsaw continued to attack and managed to destroy the target with his 30 millimeter cannon just before he crashed at high speed.

The destruction of this target helped to clear a safe path for a large number of troops to move forward behind enemy lines and undoubtedly saved a number of lives. The extraordinary heroic courage and conspicuous gallantry of W.O. Buzzsaw are in the highest traditions of the U.S. Army and reflect great credit upon the military services. We offer our deepest sympathies to his family and friends.

Warrant Officer Buzzsaw was a real go-getter. He was always ready to take the fight to the enemy, but if he had been a better student and not in such a hurry, he could have

Figure 7-1. A Dangerous SA-9 SAM Taken Out with a Hellfire Missile



completed his mission and not gone "gopher hunting" with a $15 million aircraft. You see, early in his attack helicopter training, he was given a list of ten rules which would keep him alive if he followed them whenever possible. Unfortunately, when the time actually came to go into combat, he violated almost all of them. Let's take a look at these rules and see if we can determine where Buzzsaw went wrong.

Rule 1: Avoid Target Area Overflight

There is not a single weapon aboard your aircraft which can shoot straight down or behind you—so why give your enemy the best possible target *and* not be able to shoot back when you fly directly overhead? But this is exactly what Buzzsaw did.

When Buzzsaw came under fire, he made a high-speed run at the target—and, in the process, flew very close to an enemy infantry detachment. This detachment fired at such close range that Buzzsaw had no time to react. Taking hits in the rear of the aircraft will, at the very least, damage your

Figure 7-2. An Apache Hovers to Fire a Hellfire Missile

flare and chaff launchers and could possibly result in the loss of an engine.

Remember that when entering a target area for the first time, you're not sure of what you'll find, and you have no idea what is behind the area. Caution is advised. If you're having trouble hitting a target, it's often better to turn away,

get low, and make another pass, rather than take a lot of close-range punishment and possibly fly into an even more dangerous rear area.

Rule 2: Use the Maximum Standoff Range Available

The further away from a target you can be and still destroy it, the safer you'll stay. The AH-64A has the capability to attack from a long way off using Hellfire missiles and rockets. Use this ability, and you'll stay out of range of as many enemy guns as possible. If you have the opportunity to engage a number of targets from a hover at maximum range, take advantage of it. If you start to come under fire, you can always descend or even land for a second to make the enemy lose sight and then pop back up to continue the attack.

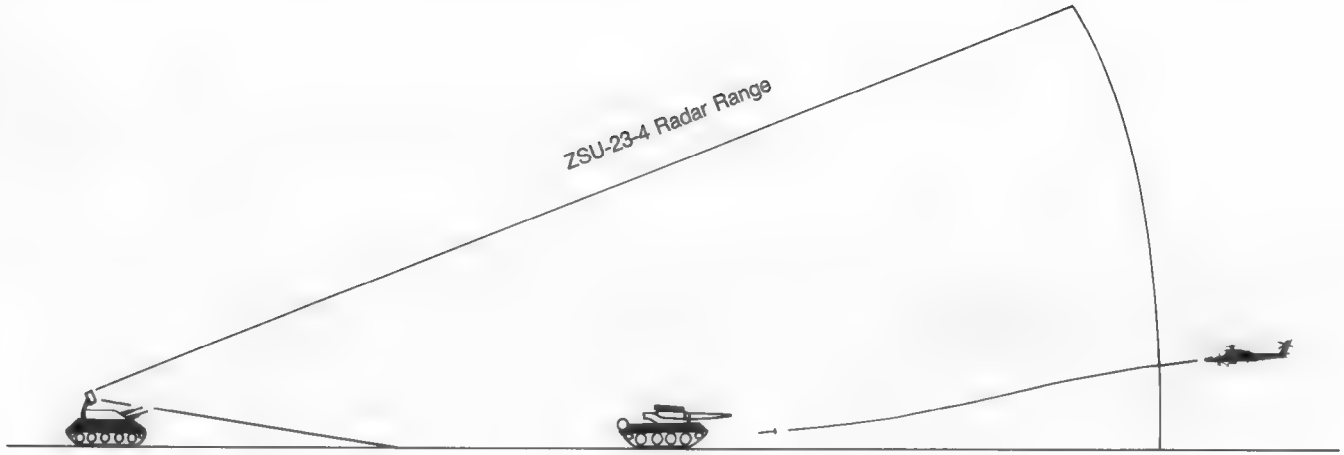
The target that Buzzsaw was after was a mobile SAM launcher. Had he chosen to use a Hellfire missile attack, he could have stayed clear of the infantry SAMs and completed his mission with little trouble.

Rule 3: Avoid Flight in the Dead Man's Zone

In *Gunship,* flying above 100 feet is extremely dangerous. You become visible to a large number of enemy positions that fire at you before you can react. By staying low, you'll avoid detection, observation, and the resulting fire for as long as possible. Also, once you're spotted, flying low reduces the amount of time that you remain in the enemy's field of fire. Often you'll be gone by the time the enemy's weapons are up and ready to fire.

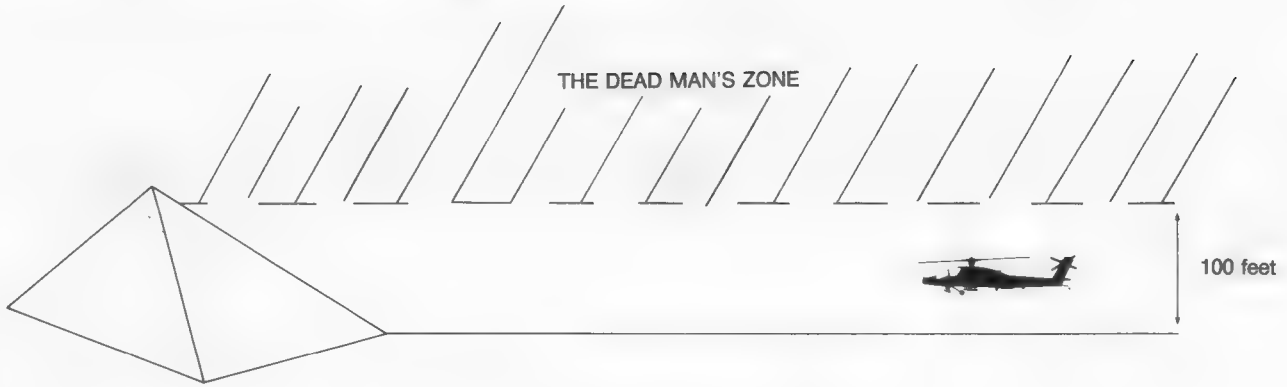
If you fly too high in *Gunship,* you can draw fire from all the way across the sector map. If you know that there are a number of bad guys behind a hill, going over the top puts you in sight of all of them. Unmasking laterally, or sideways, lets you engage targets one at a time, keeping you behind the hill and out of sight of the rest of them.

Figure 7-3. Rule 2: Use Your Maximum Standoff Range



Firing from the maximum range in this situation allows you to attack the advancing tank without coming under fire from the ZSU-23-4 AA gun.

Figure 7-4. Rule 3: Avoid Flight in the Dead Man's Zone



Flying below 100 feet will keep you below the hilltops and out of sight for as long as possible.

When Buzzsaw decided to go over the hill, instead of around it, he made a mistake. The hill was 250 feet high, and, when he crossed the top, his shape was silhouetted against the sky, making him visible to every enemy in the valley.

Rule 4: Whenever Possible Make a High Reconnaissance

Though not practical in all situations, if you have the opportunity to pop up and take a quick look around before entering a dangerous area, take it. When taking a look, restrain the urge to take a quick Hellfire shot. Firing a Hellfire means that you'd have to stay high until the missile makes contact. This would probably result in you taking several hits as well. If a target is close to your base, it may be possible to locate all the enemy positions in the area by popping up directly over the base. The best way to perform this maneuver is to use a lot of up collective to get high as quickly as possible and then cut both engines to lose altitude in a hurry.

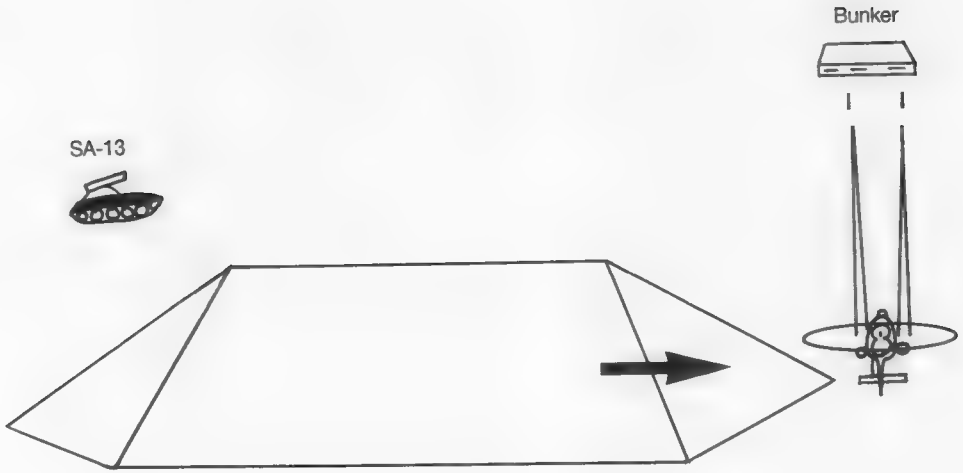
If Buzzsaw had taken the time to take a quick peek over the hill, he'd have seen the infantry troops and either gone around them quickly or taken care of them on his way to the target.

Rule 5: Always Assume That the Area is Hot

When going into an area for the first time, always expect there to be a SAM launcher over every hill and an SA-7 behind every bush. If you go rushing from one area to another thinking that there is nothing in between, you'll likely find out the hard way that this is not the case. Proceed with caution and always be ready to head to a safe area if things get too hot.

Buzzsaw made the mistake of assuming that the target he was after was the only enemy position in the area.

Figure 7-5. Lateral Unmasking



Unmasking from behind this hill laterally allows you to engage this Bunker while still out of sight of the SA-13 on the other side.

Rule 6: Always Positively Identify Targets Before Attack

"Cease fire! Friendlies have been hit!" is a radio call you do not want to get. Often in battle, there won't be clear and identifiable lines—so take care to identify all targets to avoid shooting at the good guys.

Rule 7: Conserve Ordnance and Use It Wisely

Remember your mission and make sure you reserve enough ordnance to complete it. It does little good to fight your way into an enemy area only to find that you're out of the necessary ammunition to complete the job. Relying on the gun in such situations can be very dangerous, due to its limited range. Weather conditions may severely limit the weapons load you can carry, so be extra conservative when flying with a small ordnance load. Fighting your way into an area may also mean fighting your way out again, so keep your plan of retreat in mind.

When involved in a heavy battle be sure to take enough time when firing and selecting weapons to pick the correct weapon system for the target and use proper system-switching procedures. Remember that you cannot switch from Hellfires until the missile hits or you'll shut off the laser tracking system. However, you can switch from rockets immediately after firing because they are unguided.

Rule 8: Know the Situation

It's very important to pay attention to the S-2 briefing before your flight. In this briefing, you'll find out what you're up against. Different enemy weapon systems are vulnerable to different countermeasures, so it is vital that you get some idea of the types of antiaircraft weapons facing you.

Other important items will be learned in the preflight briefing, such as weather conditions and the location of the target. Weather conditions greatly affect how much weight you can carry and thus have an influence on your plans for attack.

Get some idea of the distance to your primary and secondary targets. If they're far away, you might want to carry a lighter load to conserve fuel. If, however, you'll be flying with a tail wind to the target, you might want to carry a heavy load.

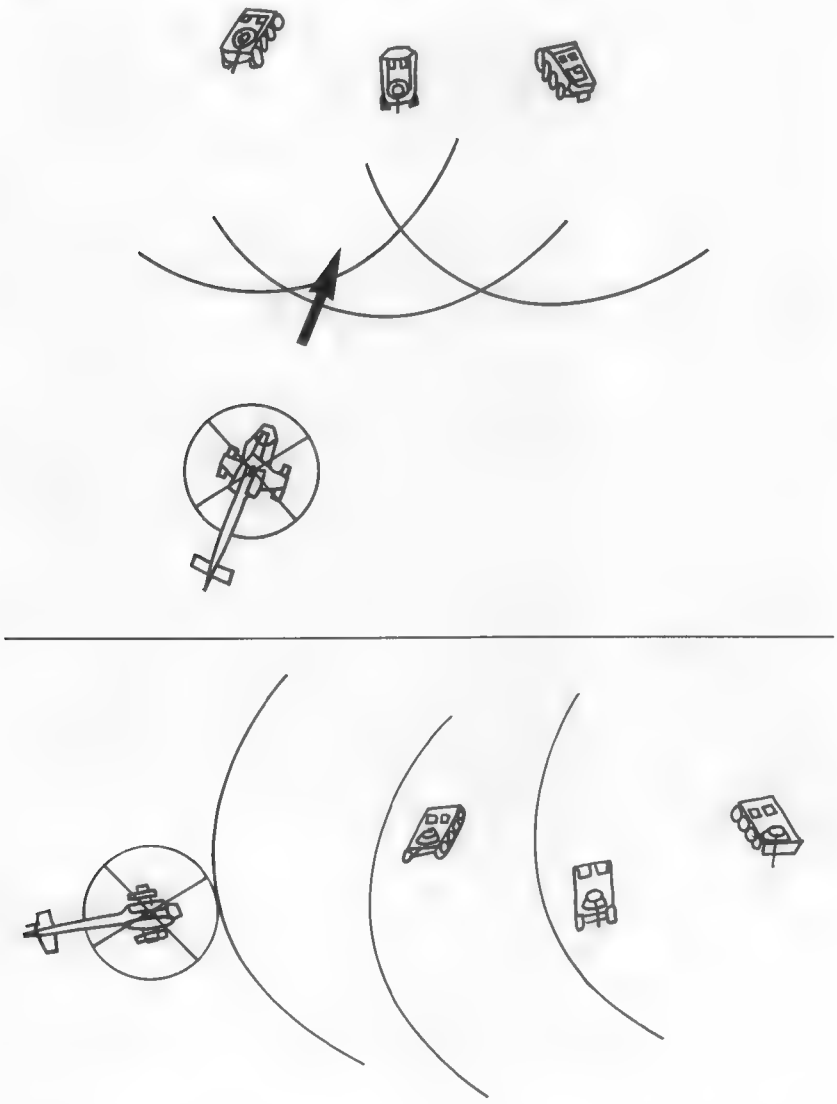
Also note the positions of friendly ground forces and huts near the target area. Landing close to these positions may save your life if you get shot down.

Rule 9: Attack from the Enemy's Flank, Across the Front Line, If Possible

Attacking across, or parallel to, the enemy FLOT (Forward Line Of Troops) will limit the number of enemy locations which can see you. If you attack directly into the enemy front, perpendicular to this line, all of the front-line positions will see you at about the same time. Many will have a chance to fire at you before you can locate and destroy them. If you attack down this line, as opposed to attacking into it, you'll have the opportunity to line up a number of targets and take them one at a time. Meanwhile the targets beyond the one you are attacking won't be able to see you. Planning your attack in this manner will also let you know that you have a safe retreat in the opposite direction from the enemy. A quick bank away from the enemy should always take you out of danger and give you time to examine your map and plan your next move.

Had W.O. Buzzsaw made his firing run from a flank position, he possibly would have had time to spot the ground troops and attack them. At least he would have known which way to turn to get away from their attacks.

Figure 7-6. Rule 9: Attack from the Enemy's Flank



Top: Attacking head-on in this manner soon puts you in view of at least two enemy BTR's, possibly three. While you're firing at the one in the middle, the other two will be firing at you.

Bottom: With a Flank Attack, you can be seen by only one BTR at a time, and you can attack each in turn.

Rule 10: Take Your Time!

Impatience probably kills more *Gunship* pilots than anything else. You just cannot go flying into a heavily defended enemy area at 120 knots at 100 feet and expect to survive. At that kind of speed, you'll encounter enemy positions faster than you can destroy them and that means that they'll have a chance to fire at you.

This kind of attack will quickly place you deep in enemy territory where you'll be targeted by a large number of weapons. You won't have time to examine the map to see where the enemy locations are and plan a way around them. So take your time to learn and follow the other nine rules (almost all of them deal with taking your time in some way).

Soviet antiaircraft doctrine is based around defense in depth and in overwhelming numbers—so don't be in such a hurry that you fly into the strength of their defense and put yourself at a disadvantage. Use your mobility, your position on the high ground, and your ability to attack from long range to give yourself the advantage, and thus, successfully complete your missions.

These rules are set down to act as guidelines and to point out dangerous situations. They should be followed whenever possible. Obviously, there are conditions under which each of them can and should be broken in order to stay alive or to accomplish a mission.

Chapter 8

Air-to-Air Combat

Chapter 8

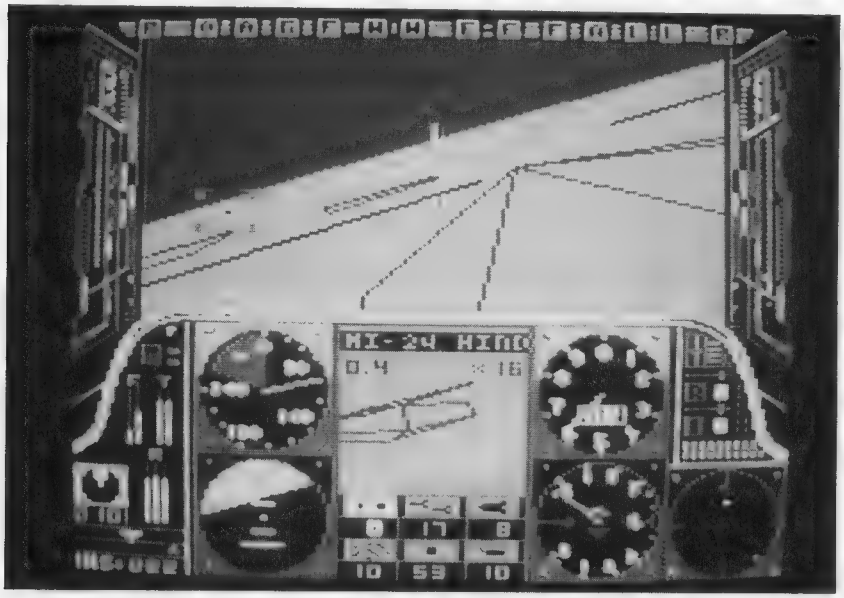
> Just as tanks have always been the most effective weapon against tanks, helicopters are the most efficacious means of fighting helicopters. Use of helicopters by both warring sides will inevitably lead to clashes between them. Like tank battles of past wars, a future war between well equipped armies is bound to involve helicopters.
>
> —Colonel M. Belov
> Soviet Army
> Published in Soviet Military Review

Since the beginning of warfare, similar weapons and forces have seemed to attract each other on the battlefield. Knights fought knights, infantry fought infantry, cavalry always seemed to find the opponent's cavalry, and tanks were used to counter tanks. It is a logical assumption then that sooner or later helicopters will fight helicopters.

The Soviets have realized this for quite some time now and, according to some experts, have a lead in the area of tactical development. They have taken a typically Soviet approach to the problem by creating a large, fast, armored, multipurpose aircraft (the Hind) and building it by the hundreds. What they lack in technology, they intend to make up for in sheer numbers. Consequently, NATO forces will face a larger number of fast, heavily armored Hinds on the future battlefield. Since the basic premise of war is for each side to shoot until one side can't shoot back any more, if the NATO forces are to win, each NATO helicopter is going to have to shoot down a number of Soviet helicopters.

That is the task you are presented with in *Gunship.* The enemy has plenty of Hinds to throw away, so you'll have to take them one by one until you complete your mission.

Figure 8-1. A Broadside Gun Attack on a Soviet Hind Helicopter



So how do you go about taking care of the never-ending stream of Hinds? Helicopter air-to-air combat is like fixed-wing air combat, with a difference. Due to the low speeds and low altitudes involved, a helicopter fight is more akin to a cat fight than a dog fight. It will be very quick and furious, and disengagement is almost impossible once the fight starts. The tactics, however, do resemble those used by fighter pilots.

This type of combat is relatively new and as such the tactics and guidelines are still being established, but a few nuggets of usable information have appeared. So pay attention—great rewards of rank, medals, and high point scores will follow all ye who observe these rules!

The Five Cardinal Rules of Helicopter vs. Helicopter Combat

★ *Stay low.* Fighting a helicopter is a very dangerous undertaking. Don't make it more so by gaining a lot of altitude in the process, thus making yourself vulnerable to enemy AA guns and SAMs at the same time.

★ *Fire at maximum standoff range.* The main advantage you have over the Hind is the ability to fire missiles and rockets while out of range of the Hind's guns. Don't give up this advantage by engaging in a close-in gun fight unless you have no choice. This type of fight can be quite exciting, to say the least, but quite often the Hind pilot will hand you your lunch in little pieces!

★ *Fire first.* This goes hand-in-hand with the second rule. Keep an eye on your threat display so you can locate and engage the enemy at long range. If you're quicker on the draw and get the first shot in, you have a good chance of winning.

★ *Lose sight, lose fight.* Helicopter fights take place very quickly. If you get into a position where you can't see your opponent, you're in big trouble—especially if the enemy can see you. Once the fight is on, take great care to use the right and left view keys to maintain visual contact. As long as you can see the enemy, you have a good chance of hitting the target.

★ *Mission first.* One of the major concerns that the Army has regarding arming helicopters for air-to-air combat is that the pilots will go off chasing enemy helicopters instead of performing their assigned ground attack or support role. Part of any soldier's mission has always been self-defense, so if you're attacked by an enemy helicopter, you should defend yourself. Don't get so carried away, however, that you go hunting for Hinds—unless you have completed your assigned mission.

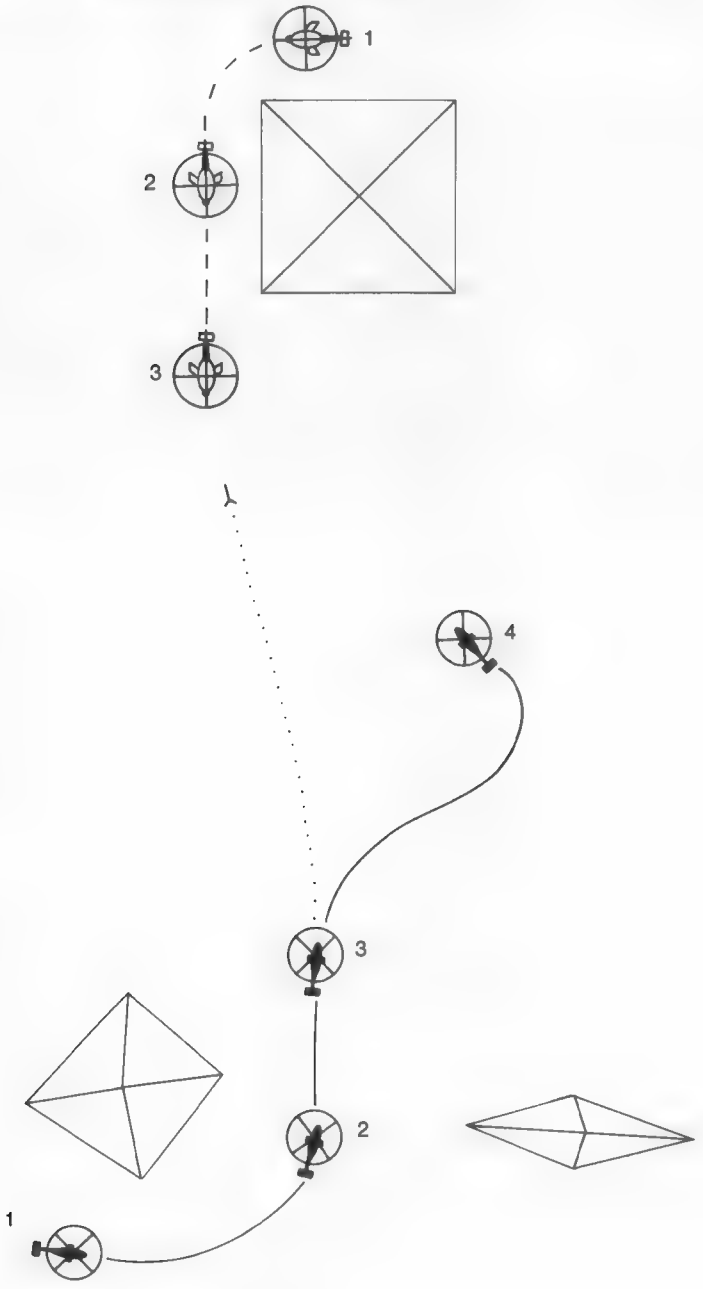
Air-to-Air Tactics

Almost all air-to-air combat boils down to identifying the advantage you have over your opponent and exploiting it. This is especially true when fighting helicopters due to the short duration of the fights. You'll generally get only one good firing opportunity, so make it count.

The Head-On Missile Attack. This tactic is best employed when fighting a Hind in a heavily defended area where you must keep moving to avoid enemy fire.

★ The enemy is located on your threat display. A look in that direction shows that the opponent is behind a hill.
★ Start to accelerate towards the Hind as it comes out from behind the hill.
★ When you're sure that the enemy has cleared the hill, fire a missile. Remember that you don't have to get a TADS lock to target a Sidewinder missile. Locking onto any ground target to activate your weapons will allow you to fire the missile, which will seek out air targets on its own. Immediately after firing the missile break hard away from the Hind.
★ If your first shot misses, turn back towards the target and fire a second shot. (You could also use rockets with this tactic if you're out of Sidewinders.)

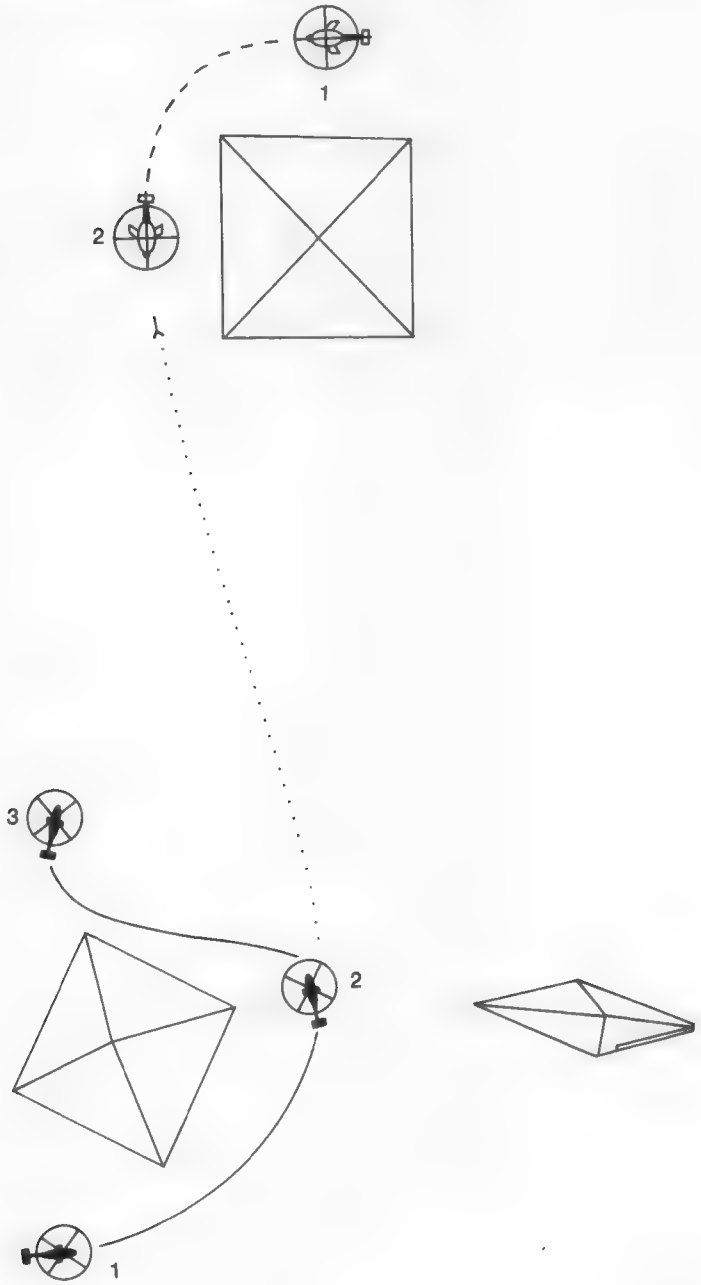
Figure 8-2. The Head-On Missile Attack



The Hovering Missile Attack. In situations where a Hind appears while you're over safe territory, you might want to wait for the enemy to come to you. If so, use this tactic.

★ A Hind appears on your threat display, and you aren't threatened by enemy ground fire.
★ Move to an area where you have a clear field of fire in the direction of the Hind and hover. Get as low as possible; 12 feet is not too low. Use your tail rotor to scan the area where the enemy is until you can lock on with the TADS. A TADS lock will probably be necessary if there are no other targets in the area. Scan over a wide area, as the threat display is only approximate. Once you locate the Hind, fire a missile and move away immediately.
★ If your first shot misses, turn back to the target and take another shot.

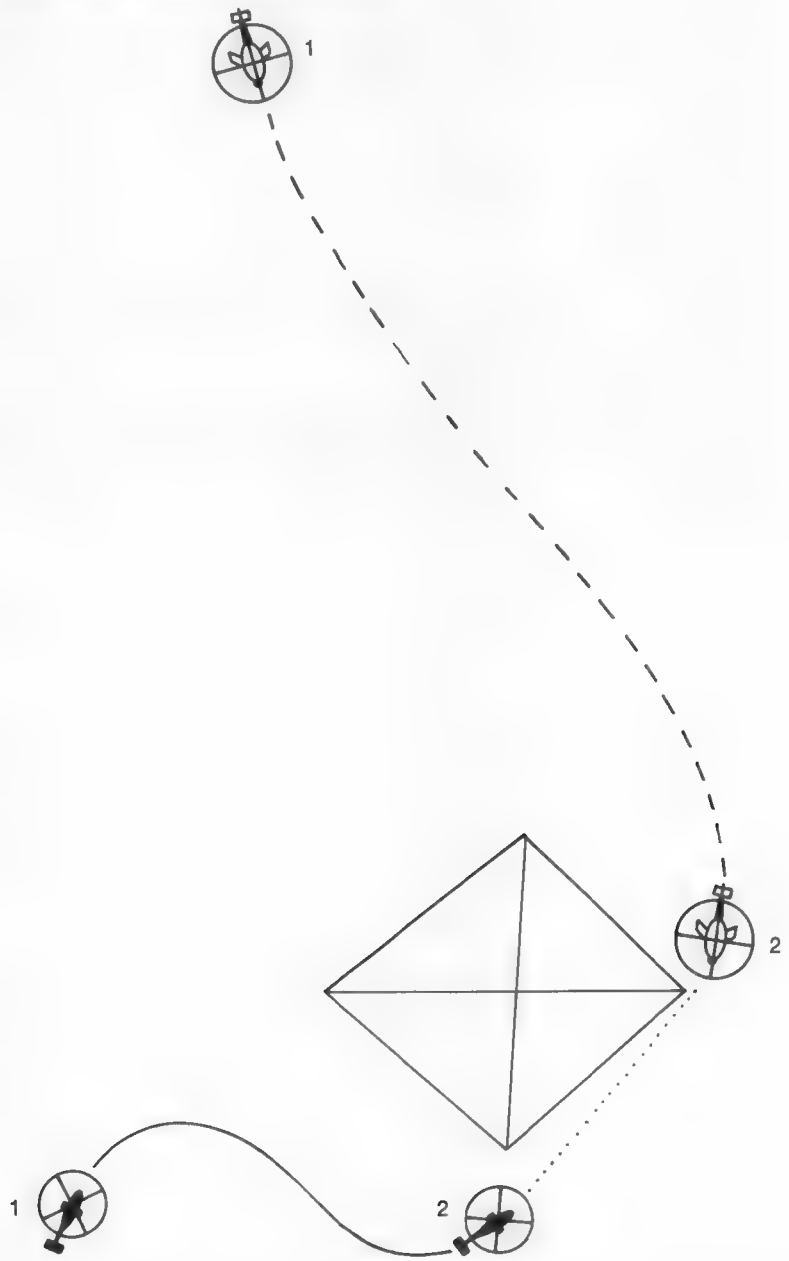
Figure 8-3. The Hovering Missile Attack



The Waiting Gun Ambush. Unfortunately, you do not have an endless supply of Sidewinder missiles. There will be times when you will have to face a Hind with your gun only. This is a good tactic for those situations.

★ The Hind is spotted at long range on the threat display, and you're out of missiles and rockets but not under immediate enemy fire.
★ Locate a hill and position yourself as close as possible behind it in a hover. Watch the threat display to determine which way around the hill the Hind is coming and turn in that direction. If you've positioned yourself correctly, when the Hind comes into sight it will also be in gun range—so be ready to fire as soon as it turns the corner.

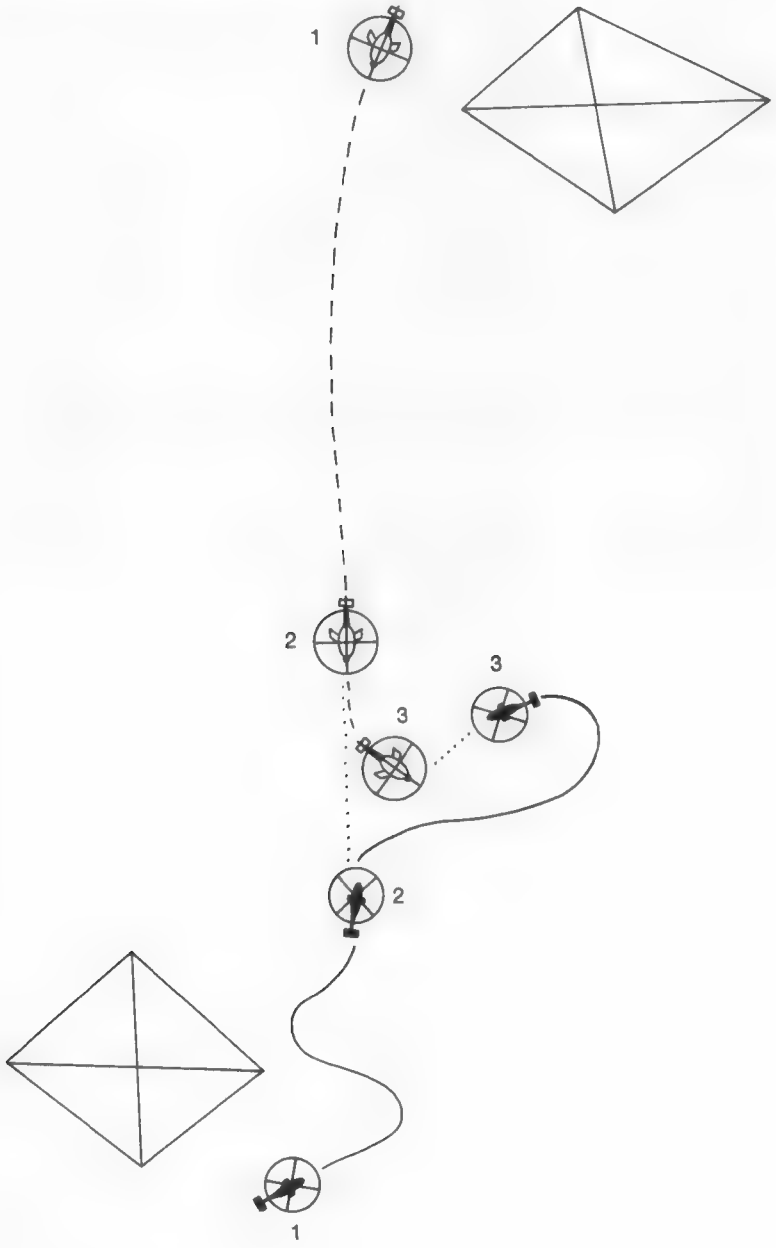
Figure 8-4. The Waiting Gun Ambush



The Head-On Gun Attack. There will be times when you are out of missiles but cannot hover and wait for a gun ambush due to low fuel or enemy ground fire. In this situation, a dangerous head-on attack may be your only hope. If flown skillfully, this tactic will work—but expect to take some hits.

★ The target is sighted heading towards you. Turn towards it, accelerate, and start a series of zigzags to avoid the Hind's guns.
★ When the range closes to less than 1 kilometer, bank hard to the left and then pull up and bank hard back to the right while slowing down.
★ The Hind will not be able to turn as well as you can, so as you turn back towards it, you should get a chance for one quick shot at the side of the Hind as the enemy overshoots you.

Figure 8-5. The Head-On Gun Attack



The Side-Flare Quick Stop. Even the best pilots occasionally get so caught up in a battle that they let a Hind sneak up on them. The worst position you can find yourself in is to have a Hind in your six o'clock position at close range. If this should occur, the best thing you can do is perform a side-flare quick stop.

★ Your threat indicator shows that a Hind is behind you and closing fast. Often, the first indication you get that it's there is the sound of cannon shells hitting your aircraft. Immediately pull back hard on the stick to slow down your aircraft as fast as possible. Don't worry if you gain some altitude, that's OK.

★ The larger and heavier Hind won't be able to stop that quickly. Watch the threat display. Once the Hind passes you, bank into its six o'clock position and dive to pick up speed.

★ When you pull in behind the Hind, nail it with your gun as soon as possible. The Hind is faster than you and will soon pull out of gun range if you do not act quickly.

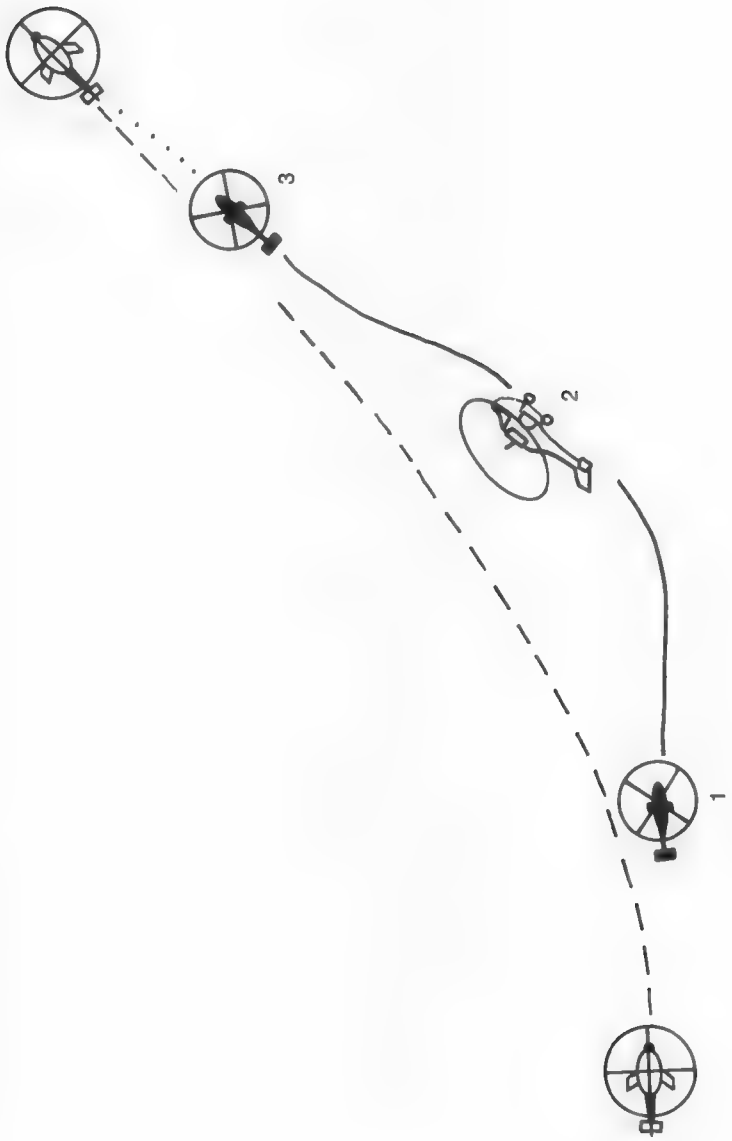


Figure 8-6. The Side-Flare Quick Stop

Chapter 9

Defensive Tactics

Chapter 9

We've already seen how the enemy uses mix, mass, mobility, and integration to form an overlapping defense in depth. With all that working against you, what can you do to increase your chances of successfully running the gauntlet and completing your mission? That question is best answered by looking at the two types of antiaircraft countermeasures you can employ—active and passive.

Active Countermeasures

Suppression. One of the best ways to stop enemy troops from shooting at you is to shoot at them. In the worst case, suppressive fire causes them to dig in and take cover, limiting their ability to return fire, and in the best case, it destroys the enemy position.

The proper use of standoff is important when laying down suppressive fire. Whenever possible, use the maximum range of your weapons to force the opponents to keep their heads down while you move in for the kill. Also, when using this method, you need to suppress the closest and highest-threat target first, so take a quick look around to make sure you know what you're up against. Getting off a heavy volume suppressive first shot will give you an advantage over the battlefield.

Preflight planning. Before you take off, you should have a good idea of where you're headed and how you're going to get there. If your target is a long way off, you should expect to meet trouble on the way, so plan your speed and altitude accordingly. Also, plan your attack on the mission target. If you're going to a rear area, such as a depot or HQ, plan on encountering heavy protective AA coverage. Don't rush in too fast.

Figure 9-1. Two Apaches Safely Heading for Home

Passive Countermeasures

Utilize N.O.E. terrain flight. Flying nap-of-the-earth is your best countermeasure against most AA weapons. Army Field Manual 90-1 defines terrain flight as "the tactic of employing aircraft in such a manner as to utilize the terrain, vegetation, and manmade objects to enhance survivability by degrading the enemy's ability to visually, optically, or electronically detect or locate the aircraft. . . . Terrain flying, of necessity, involves flying close to the earth's surface."

Many of the enemy's weapons, although IR guided, require a visual sighting before launch. Flying low and staying behind hills will prevent the enemy from being able to acquire you visually and will stop the use of a number of weapons.

Employ standoff. The further away you are from the enemy position when you make an attack, the better the chance you have of destroying it before the enemy can launch. If they do launch before they're destroyed, being a good distance away will give you time to react and break contact with the enemy missile. Using NOE flight to get to a target area and then gaining some altitude to employ maximum standoff is a good combination of passive countermeasures.

Watch your threat indicator. Most enemy systems will show up on the Threat Indicator. Knowing that they're there and where they are will allow you to make good decisions as to whether to attack or evade. Enemy systems that appear on your flank can often be avoided by flying low and away from them. This is a good tactic to employ when on your way to a target area. By turning and attacking the weapon on your flank, you not only use time and fuel, but you might get drawn into a heavily defended area where you would receive a lot of damage before you could get out.

Minimize exposure time. It takes time for the enemy to set up and get off a shot at you. By limiting this time as much as possible, you'll decrease your chances of getting hit. You can limit your exposure time by doing the following:

Flying fast. High speed gets you in and out of range quickly, which is good. High speed also can get you into range of a large number of weapons faster than you can destroy them, which is bad. Bursts of speed are good for getting out of view quickly but should not be used for extended periods when over unknown territory.

Flying low. Enemy radar has very limited range at low altitude. The lower you are, the quicker you'll get out of range.

Using pop-up attacks. Popping up from behind a hill just long enough to attack a target and then dropping back down out of sight will limit the time the enemy has to acquire you and react.

Use your ECM properly. Electronic Countermeasures are great when used correctly but can be fatal if used when not needed. The time to use your radar and IR jammers is once you have been located by the enemy. These systems put out a very strong signal which is used to overpower the enemy system. They can be detected over a very long range, giving the enemy time to prepare for your attack. Limited use at night is especially important since the enemy will have a hard time acquiring you visually. You don't want to eliminate this advantage by flying around with your jammers on.

Use your decoys properly. Flares and chaff can save your life when a system cannot be jammed, but only if you maneuver correctly. When a missile is approaching you and you drop a flare or chaff, you must maneuver and change direction. Most missiles, once they lose their lock on you (even if jammed) will continue on straight ahead. If they were headed for you before they lost lock-on and you keep on the same flight path, you stand a good chance of getting hit anyway.

Keep moving in exposed areas. Once into a hot area, you are going to draw fire from a number of sources. Be careful not to pay so much attention to one target that you set yourself up for another. Don't hover unless you're protected by a hill and then keep a watch on your altitude. If you keep moving and feel that things are getting out of hand, you'll have enough speed to get out of the area in a hurry at low altitude.

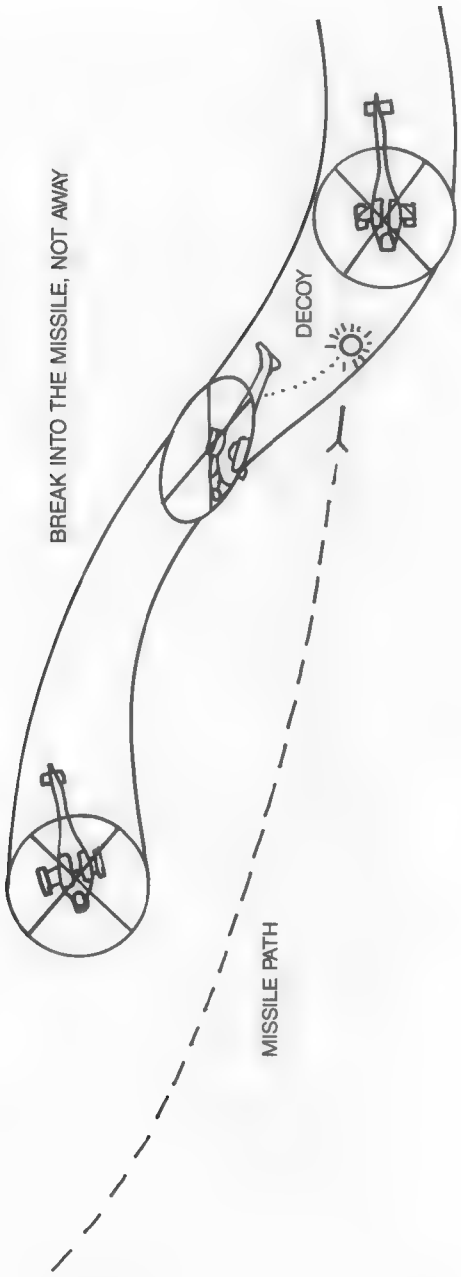


Figure 9-2. Proper Use of Flares and Chaff

Damage!

If you aren't successful with your countermeasures, you're going to get hit eventually. The amount of damage sustained will depend on where you're hit and what type of weapon hit you. Every time you take a hit, check the system damage lights across the top of the screen. You must keep up with what works and what doesn't.

Damage to certain systems can drastically alter your mission plan. If you're loaded with Hellfires and planning to take out a depot with your gun, you had better keep a look out for damage to the gun. If it should get hit, you have no way of destroying the depot. In this case, you might want to change course to the secondary target if it can be destroyed with Hellfires, or you might choose to just hang around the base long enough to use up all of your Hellfires and then land for a reload with FFARs.

Whether or not damage to a particular system is critical will depend upon your mission and situation. There are some systems, however, to which damage is always troublesome. Let's look at the damage-panel abbreviations and possible damage to each area (listed in order of their appearance from left to right across the display).

R (Main Rotor)	If the main rotor is damaged, it's serious enough that if it gets hit again, you're going down. Flying with a damaged rotor is aggravating but can be done. Fortunately, this system does not seem to get hit very often.
O (Nose Optics)	This system is very important since it controls the TADS aiming system. Damage is troublesome; destruction of this system means it's time to head for home since you cannot lock onto targets to activate your weapons.
A (Forward Avionics Bay)	Damage or destruction of this system is not critical to completion of your mission, but you'll lose some of your gauges (most importantly, your fuel gauge).
G (Gun)	Damage to the gun does not mean that it cannot be used, but generally it means that it can no longer be aimed with the TADS system. With a

	damaged gun, you'll have to aim it by pointing the aircraft like you do to aim your rockets. Total loss of the gun can be ignored if you're carrying rockets or if you can ignore soft targets.
F (Fuel Tank)	If this tank is damaged, your flying time will be significantly reduced. If this happens, it may be time to head for home or go for a secondary target.
W (Wing)	It is not damage to the wing that is important here, it is the loss of the weapons on the wing. In most cases, the wings will be destroyed, not damaged, with the first hit. If a wing is lost, you'll lose half of all your weapons except for gun ammo. This includes Sidewinders, so if, for instance, you have fired one and you lose the other wing, you will be left only with your gun as the defense against Hinds. Take that into consideration when deciding whether to go on or turn back.
E (Engine)	The loss of an engine is serious, though you can continue if you're careful. If you lose both, you'll have to autorotate to land and possibly get captured or killed. Weather conditions will effect how well the aircraft will perform with the one remaining engine. If you are in the Middle East where temperatures and elevations are high, you might have to jettison some of your weapons to stay up or to hover.
A (Aft Avionics Bay)	This bay contains your jammers and navigation equipment, the loss of which could make your target, and home, hard to find and make missiles hard to avoid. This area seems well protected and does not go out often.
L (Launchers)	Losing a flare or chaff launcher can be serious but can be overcome by using maximum standoff when attacking and using pop-up techniques to shield you from missiles. Since you'll be attacked more frequently by IR missiles, losing the flare launcher is the more serious of the two.

R (Tail Rotor) — A damaged tail rotor is very serious. It takes a lot of guts and skill to continue on with a bad rotor. The aircraft will be very hard to control and that makes firing rockets almost impossible—so stick to guns and Hellfires. If the rotor is destroyed, you won't have control over the direction of the aircraft. You'll have to land sooner or later, but if you seem to be drifting away from the enemy, you might want to tough it out for a while to increase your chances of evading capture.

Operating with a damaged aircraft is troublesome but is the test of a great *Gunship* pilot. Medal of Honor winners will all tell you that they got shot up pretty badly but continued on to finish the mission.

Repairing damage is another factor that you must consider. Remember that if you have your damage repaired when you return to base, the enemy will have time to replace some of the targets you destroyed. If you have cleared a safe area around your base or a path to your target, you wouldn't want to repair damage and have some of those targets reappear. The really great pilots have been known to fly second missions with one wing, no flare launchers, and a damaged rotor because they knew that they had a clear path to the target and all they had to do was zip out to a good standoff range, blast the target, and zip back.

If high scores and winning medals are your goal, then you must learn to fight on with a sick bird. Skills such as dodging missiles without jammers or decoys can be practiced over the training area and is a good idea. Learning to jink a missile is a valuable and difficult skill and well worth study.

When jinking a missile, remember to break towards the missile to force it to turn as sharply as possible. You must also wait until the last second before turning or the missile will have time to react. There is only one way to learn this skill and that is with practice.

Take time to plan your mission, keeping in mind your active and passive countermeasures. React to threats quickly by watching your threat display and know your damage condition. If you can balance your time between those two tasks and trying to make a good attack, you'll have a much longer and more productive life as a *Gunship* pilot.

Chapter 10

Playing the Game—Tips and Information

Chapter 10

There are no two ways about it: *Gunship* is a very complex game. Each player must decide his or her own goals for a particular play session and then set up the game accordingly. Do you want to try for the Congressional Medal of Honor, are you interested in advancing in rank, or do you just want to go on a fun mission without too much pressure? The purpose of this chapter is to let you know more about playing *Gunship* and how the different areas of the game work. Whatever your goals are, understanding more about how the game is set up will make them more achievable.

Scoring

A lot of things in this game are affected by your score, so let's examine the scoring procedure first. The folks at MicroProse have developed a complex but clever two-part scoring system. The first part of the system awards a set amount of points for each target destroyed. The more dangerous targets carry higher point levels:

Target	Points Each
Hind helicopter	30
S-60 57mm AA gun	28
ZSU Mobile AA gun	26
ZU-23 23mm AA gun	25
SA-8 and SA-11	24
SA-9 and SA-13	22
Infantry	20
Heli-base	20
HQ	20
Depot	20
BMP	16
Bunker	16
Tank	14

Hitting U.S. or NATO forces will result in reductions in score:

Target	Points Each
Heli-base	80
Tank	60
Infantry	30

These point totals are added up, and then a bonus is added to that total for completing the primary and secondary missions. This total score is then multiplied by a series of modifiers. They can be either a number greater than 1 (to reward you for difficulty and increase the score), the number 1 (to keep your score the same), or a number less than 1 (to penalize you and reduce your score).

The modifiers fall into the following categories (the items in each category are listed from top to bottom in order of decreasing point value):

Geographical Area
Western Europe
Middle East
Central America
Southeast Asia

Quality of the Enemy
First line
Second line
Third line

Mission Style
Hazardous
Volunteer
Regular

Reality Levels
Real Flight
Real Landings
Real Weather
Easy Flight
Easy Landings
Easy Weather

Time Factor

If it takes more than 22.5 minutes to complete your missions, you'll be penalized an increasing amount as the time lengthens. Be aware that the clock starts as soon as the cockpit screen comes up, so don't waste a lot of time looking at the map. You should have your attack plan set beforehand by looking at the map during the briefing.

With this type of scoring, you're rewarded for taking risks and using the realistic modes of the simulation. Since other important parts of the game, such as rank and medals, are based mainly on your score, it's to your benefit to understand how this system works.

Winning Medals

Winning a medal is based completely on your score for a particular mission (your previous scores and rank are not considered). Winning a second medal of the same type is very difficult and requires about twice the number of points as it did the first time.

The question most frequently asked of the game designers at MicroProse is "What the heck do I have to do to earn the Congressional Medal of Honor?" Well, it's really quite simple. All you have to do is

★ Score 5000 points
★ Complete both missions
★ Shoot down at least two Hinds
★ Get wounded
★ Live and don't get captured
★ And do all that in less than 22.5 minutes

See, just a walk in the park! The other medals are based on similar criteria with fewer points required.

Acquiring Rank

Promotions are based on the following table:

Points	Rank
1200	Second Lieutenant
4000	First Lieutenant
10,000	Captain
25,000	Major
50,000	Lieutenant Colonel
100,000	Full Colonel

The point total required for a particular rank is reduced according to the number and type of medals you've received. This means it's very possible to reach the rank of Full Colonel with a point total much lower than 100,000, if, for example, you've been decorated frequently. The point total can be increased though, if you've received an official reprimand for going on sick call rather than taking a dangerous mission. So if you get a mission that you really don't want to try, it's better to end the game and reboot the program than to go on sick call.

Tips on Using Your Weapons

The chain gun. The 30mm chain gun is a very versatile weapon and can be used on almost any target effectively. It's most successful when used at a range less than 500 meters, or .5 kilometer on the screen. At ranges greater than 500 meters, it's best to use your rockets. They can have the effect of suppressing ground activity even if you do not score a direct killing hit. This lets you get close enough to use the gun.

If you hold your fire until the range is 300 meters or less, you'll almost always get a kill with the first chain gun shot.

The Sidewinder missiles. The AIM-9L Sidewinder missiles provided are also very good weapons. One thing that's not widely understood about using these missiles is that they aren't tied to the TADS system for targeting. This means that if you know that a Hind is coming at you, and you're

sure there isn't a hill between the two of you, you can lock onto any target (to arm your weapons for firing) and fire a Sidewinder without locking onto the Hind with the TADS sight.

The Sidewinder, being a true fire-and-forget weapon, will home in on the Hind's IR pattern and attack it if it's close to being directly in front of you. This is important to know because, in the fury of battle with a number of targets in the area, it's sometimes difficult to identify the Hind on the TADS system (even though you know it's close to you by looking at the Threat Display).

The calculations which determine whether a Sidewinder scores a hit are based mainly on the setup (your position and speed in relation to that of the enemy) when you fire the missile. If your first missile misses the target, the worst thing you can do is to immediately fire another using the same setup, because it will miss also; you must improve your position before firing again. Try firing with the Hind closer to the center of your screen.

Another wasteful practice is shooting two Sidewinders at the same time, "just to make sure." Since both missiles would have the same initial setup, they'll both either miss or hit, and, either way, you'll have wasted one valuable missile. You should also know that if you're very concerned about the Soviet helicopters, you can carry more than two Sidewinders. The weapons pods can be fitted with up to six Sidewinders, but if you do that, the only other weapon you'll have is the chain gun.

Hellfire missiles. Next time you fire a Hellfire missile, note that as soon as it hits the target the TADS designator box jumps immediately to the next target without you manually hitting the Next TADS Target key. The reason for this feature is to allow you to "ripple fire" these missiles.

When you ripple fire, you have more than one missile in the air at one time. This cuts down the time it takes to engage and destroy a number of targets. For this to be successful, all of the targets must be close together, and they all

must be visible on the screen. The procedure is to fire one missile, wait a couple of seconds, and then fire another. When the first missile hits, the TADS will jump to the next target. If you have allowed enough time for the second missile to change course, it will turn and hit the next target. With proper timing, you can have three missiles in the air at once.

During the flight of the Hellfire, you're vulnerable to attack from other sources because you cannot change TADS targets, dive, or make sharp maneuvers until the missile hits (due to the laser aiming system). Using the ripple-fire method will reduce this dangerous time period.

Sometimes during a furious battle, you might fire a Hellfire missile and then realize that it won't kill that particular target. Rather than just letting it fly on toward a soft target, start hitting the Next TADS Target key. With a little luck, you might find a suitable hard target and avoid wasting a shot. Increasing your altitude during this time will increase the chance of spotting a good target.

If you have made a Hellfire shot and start to take a lot of fire or have a SAM bearing down on you, you can take evasive action at times. If the missile is almost to the target when you lose the TADS lock, it has a good chance of hitting the target anyway without the laser lock-on.

Tips on Operating the Aircraft

Losing altitude quickly. Often when operating in a heavily defended enemy area and firing a number of weapons, you find yourself to be much higher than you would like. A helicopter can only dive so fast, and fooling with the collective takes time which you may not have. A good way to lose altitude quickly is to shut down both engines, leaving the rotor engaged. With no lift being generated, you'll fall like a stone. Once you pass through 150 feet, start the engines again, and you should bottom out at about 80 feet, depending upon your weight. By doing this, you can rapidly get back to the safety of low altitude and get out of the sight of enemy guns.

Staying unseen. There are a number of things which figure into determining whether you can be seen by the enemy, but the most important of these are altitude and speed. Whenever possible, it's best to go low and slow. A slow-moving helicopter is very difficult to see, especially at night, so if you do not have to cover a lot of ground to get to the target, you have a good chance of sneaking up on the enemy. A good rule of thumb when operating the aircraft at any time is to keep your airspeed and altitude equal: Good procedures to follow are both 80 knots at 80 feet and 60 knots at 60 feet.

Repairing damage. Damage to your aircraft will be discussed in detail later, but there is one thing you should be aware of regarding landing and repairing damage before continuing the mission. In theory, repairing this damage would take several hours, and during this time the enemy would also have time to repair damage and replace destroyed equipment. As a result, a good number of targets which you destroyed will reappear when you go back out. You'll have to judge for yourself whether this is good or bad depending upon the situation. If you have spent your first trip out clearing a path to get to your primary target, then you wouldn't want to have to fight your way through again; so, if your damage is not critical, don't have it repaired.

However, if your primary mission is complete and the secondary target is close to the base, you might want the extra points available by destroying targets a second time. Since you know where they are, finding the high-scoring AA guns should be easy. The one situation where you wouldn't want to do this is the case where you destroyed the Hind heli-base on your first trip out. With this base destroyed, you won't have to worry about Hinds for the rest of your mission. You wouldn't want to chance that base popping back up as a result of having your damage repaired.

Staying alive. First of all, you don't have to let a pilot die unless you want to. If you are "killed" or end up MIA and you want to continue to use this pilot, all you have to do is turn your computer off without turning the disk over. All of the information as to whether a pilot is alive or dead is

stored on the front side of the disk; if you don't turn the disk over so that data can be recorded, you'll be able to send that pilot out on future missions.

With that in mind, let's try not to get killed or captured in the first place. One of the most important flying skills you can acquire is learning autorotation and power-off landing procedures. These procedures should be practiced until they're second nature. The aircraft produces maximum lift at a forward speed of 60–90 knots, so try to maintain this speed during an autorotation descent. Keeping your airspeed in this range will allow you to fly the aircraft for a good distance before hitting the ground, giving you a chance to find a good place to land.

You really should take advantage of this time to look at the map and plan your landing because *the computer decides whose lines you are behind, based upon the closest troops.* If you land 1 kilometer from a U.S. base but are .9 kilometer from an enemy infantry unit, you'll be considered *behind enemy lines.*

When you are autorotating, take a quick look at the map or swing around toward your lines and look for a friendly tank or infantry unit; try to land as close to it as possible. Huts are also considered *friendly,* so if there is a hut in the area, land close to it. Take care, however, not to land on top of it since you'll crash.

Flying with a heavy load. Weather conditions will determine how much of a load you can carry. When choosing your armaments for a particular mission, feel free to load up to the maximum weight level. Just keep a couple of items in mind.

If you lose an engine before you fire a lot of weapons, you won't be able to hover and may not be able to continue flying. If this occurs, you'll have to jettison some of your weapons. Which ones you choose to drop will depend on what you're going to do. If you're going to continue on toward the target, you may want to drop any FFARs you're carrying, figuring you could use the gun on soft targets, or

vice versa. If heading for home is your plan, then dropping the heavy Hellfires would be a good idea.

If you find yourself in a situation where your lift is reduced, be careful when adjusting the collective. The rotor blades are like any other wings and can stall if the pitch is increased too much. Decreasing your weight and maintaining an airspeed in the 60–90 knot range will improve your lifting capability.

Listen to your aircraft. A great deal of care has gone into programming the sound for *Gunship.* The sound does more than provide background noise, it gives you clues as to how your aircraft is performing. If one engine has been hit, you'll notice a different sound, and the rotors will slow down. If you increase the collective too much, the rotors will also slow to let you know.

Sound is also important during the autorotation procedure. The sound of the rotors turning lets you know that you're moving forward enough to maintain lift. Get used to listening to the engine and rotor sounds for clues as to the aircraft's performance.

Two-player system. The AH-64A is a two-person aircraft. There is so much going on during a battle that two sets of eyes and hands are needed to keep up with what is going on and to effectively engage the enemy. *Gunship* was set up so that one person could function as both the pilot and copilot/gunner, but often that one person experiences what the military refers to as sensory overload. You have so many lights flashing, warning bells going off, and dials and gauges to keep up with that some are missed and others ignored—often with disastrous consequences.

In order to play *Gunship* at the highest levels of difficulty, it's helpful to use a two-player system. It is most convenient for two players to sit side by side in front of the computer, but I have heard of players who go to greater lengths to simulate the actual Apache. They sit like the Apache crew with the copilot/gunner sitting in a low chair right in front of the screen and keyboard and the pilot sitting behind in a higher chair looking over the head of the CPG.

Responsibilities can be divided in any way you choose, but I have found that the following system works especially well.

Pilot Responsibilities
★ Fly the aircraft.
★ Set the course.
★ Fire the weapons.
★ Disengage the rotor when both engines are down.
★ Give the orders; someone has to be in charge.

Since the copilot/gunner cannot fly the aircraft, he or she must be given more to do to keep from being bored and becoming a spectator. The CPG's areas of responsibility are as follows:

Copilot/Gunner Responsibilities
★ Watch the threat display and advise the pilot of enemy location.
★ Watch the IR and Radar warning lights and activate jammers when needed.
★ If jammers do not work, drop flares or chaff.
★ Advise the pilot to break right or left to avoid a SAM which has evaded countermeasures.
★ Watch the fuel level and advise the pilot when it gets low.
★ Advise the pilot when the helicopter gets too high or low during combat.
★ Select weapons.
★ Prioritize targets and change TADS designator.
★ Jettison stores if necessary.
★ Keep an eye on damage and advise the pilot when damage occurs.
★ Watch weapons levels and advise the pilot when all of a particular weapon has been used.

The Enemy

Weapons. The enemy is blessed with enormous firepower for which you must compensate with speed and maneuverability. This firepower will vary greatly depending upon where in the world you are and the quality of the troops

you're facing. The following tables list the types of weapons you'll see in various parts of the world depending upon their quality. Although this is the way the troops will be armed most of the time, you may occasionally get a surprise.

Southeast Asia

First Line	Second Line	Third Line
SA-7 (depots and HQs)	SA-7 (depots and HQs)	SA-7 (depots and HQs)
S-60 (with radar fire control)	S-60 (with search radar only)	S-60
ZU-23	ZU-23	ZU-23
Some infantry will have SA-7	Infantry won't have SA-7	Infantry won't have SA-7
Bunkers won't have SA-7	Bunkers won't have SA-7	Bunkers won't have SA-7

Central America

First Line	Second Line	Third Line
SA-7B (all infantry, HQ, depot, bases)	SA-7 (some infantry, all depots, HQ, bases)	SA-7 (some infantry, all depots, HQ, bases)
BMP (a few have SA-7B)	BMP (a few have SA-7)	BMP (a few have SA-7)
ZSU-23-4	ZSU-57-2	No ZSUs
SA-9B	SA-9	SA-9
S-60 (with radar fire control)	S-60 (with radar fire control)	S-60 (with search radar only)
ZU-23	ZU-23	ZU-23
Bunkers won't have SA-7	Bunkers won't have SA-7	Bunkers won't have SA-7

Middle East

First Line	Second Line	Third Line
SA-7B (all infantry, depots, HQ, bases)	SA-7B (all infantry, depots, HQ, bases)	SA-7 (all infantry, depots, HQ, bases)
T-74 Tanks	T-74 Tanks	T-74 Tanks
BMP (some with SA-7B)	BMP (some with SA-7B)	BMP (some with SA-7)
SA-8B	SA-8	No SA-8
SA-9B	SA-9	SA-9
S-60 (with radar fire control)	S-60 (with search radar only)	S-60 (with search radar only)
ZSU-23-4M	ZSU-23-4	ZSU-57-2

Western Europe

First Line	Second Line	Third Line
SA-14 (all infantry, depots, HQ, bases)	SA-7B (all infantry, depots, HQ, bases)	SA-7 (all infantry, depots, HQ, bases)
T-74 Tanks	T-74 Tanks	T-74 Tanks
BMP (some with SA-14)	BMP (some with SA-7B)	BMP (some with SA-7)
SA-11	SA-8B	SA-8
SA-13	SA-9B	SA-9
S-60 (with radar fire control)	S-60 (with radar fire control)	S-60 (with search radar only)
ZSU-30	ZSU-23-4M	ZSU-23-4

What quality of troops you choose to challenge affects not only the weapons you face but the reaction time of the enemy once they see you. Third-line troops react very slowly, while first-line troops react very quickly. Keep that in mind when flying into a heavily defended area.

These enemy troops are not randomly placed on the map. For each mission scenario, the troops were planned and laid out in an orderly and logical pattern, so expect extra AA sites close to bases and HQs. Mobile AA equipment will appear closer to the front. Each map setup has 60–115 targets so there should be no shortage of things to shoot at.

The targets in Southeast Asia and Central America are arranged in clumps since there are, or were, very few distinct lines in actual battles. In these areas, you can easily find yourself in the middle of a heavy concentration of enemy AA, so it is best to proceed slowly. Due to this clumping, however, there are vast areas of the map which contain no enemy troops at all. If you do stumble upon a strong group of enemy troops, you can go around them, if you choose, rather than having to fight your way through.

Hind helicopters. These Soviet helicopters don't just appear out of thin air; they actually take off from a Soviet base. When you get a message saying that a Hind is airborne, one is actually taking off. As soon as they take off, they know where you are and head toward you. You can judge how far away the enemy base is by how long it takes for the Hind to find you. If it's close by, you might be able to find it and put it out of business.

Hinds should be engaged as soon as possible. They won't go away. They tend to wait for you behind hills, but it's best not to go into a tight area looking for them. You'll have better luck if you can wait for them to come out into the open. It's also a good idea to engage them at the greatest range possible. If one is behind a hill right in front of you, it's best to move away (some pilots just hover and back up). You want to avoid a situation where you're already in range of the Hind's guns when it comes over the hill.

It would be best if you could engage the enemy helicopter at about 2.2 kilometers. This would give you a chance to exploit the greater firing range of your Sidewinders. The Hind cannot fire at you until it's about 1 kilometer away. Another reason to stay away from hills with Hinds behind them is that under certain circumstances they can see you and shoot at you right through the hill!

When a Hind is coming at you, it will generally be at a lower altitude than yours, so be prepared. Since the Hinds are faster than you are, you cannot run from them for long. You can, however, cause them to lose sight of you and wander off for a short period by flying low, flying behind a hill, or even landing if the Hind is a good distance away. You should not land, however, if the Hind is close because it can tear you up if you're sitting still on the ground!

Enemy tanks. You should note that while enemy tanks carry no antiaircraft weapons, they also give you the least amount of points when destroyed. With this in mind, it's generally better to save your Hellfire missiles for more dangerous and higher-scoring targets. If you have to destroy tanks, you can come back after the AA is destroyed and rip them up with your 30 mike-mike!

Chapter 11

The Making of *Gunship*

Chapter 11

The development of *Gunship* was a long, troubled process, though well worth the wait. Here's how MicroProse's Mike Harrison described the effort in the Gunship Newsletter (reprinted courtesy of MicroProse).

The Idea—March 1985. "A chopper seemed the natural choice for our next simulation," said Andy Hollis, MicroProse software engineer and game designer. "It was high on our list of future development projects and our customers were very interested."

Hollis, who led the Gunship Design team through 1.5 years of initial development, said the previous success of *Solo Flight* and *F-15 Strike Eagle* had proven the market for flight simulations.

MicroProse President Bill Stealey, a former USAF jet fighter pilot, was fascinated by the possibilities of a modern helicopter simulation. "Helicopters are today's cavalry," he said. "They're in the thick of the front line action where the danger is always right over the next hill or across the next river. What a great way to give consumers the chance to make real life decisions in a challenging environment!"

The difficulty of simulating a helicopter offered an exciting challenge for MicroProse developers. "But I figured we were the company with the people and the expertise to do it justice," Stealey said.

The First Attempt—Summer 1985. Research and development began in April 1985. Initially, the game was patterned after the Cobra helicopter used by U.S. forces in Vietnam. Stealey had named it *Cobra Gunship.* The focus soon changed, however, to the Apache AH-64A being developed by McDonnell-Douglas for the U.S. Army. "It was the

hottest topic of discussion in the Officer's Club," remarked Stealey, a Major in the USAF reserve. "Military people said the Apache represented the state-of-the-art in the Army's high tech arsenal, so we made the decision to change."

"I was just developing the basic flight characteristics," said Hollis, "so the change wasn't hard to implement. The Apache was appealing because it was newer and more high-tech . . . and gave us a little more latitude in game design."

The first version of *Gunship* was very different from the one that has now been purchased by more than 100,000 computer pilots. With an "almost arcade style," that first design included grid based graphics with missions in mainly urban areas. But that would soon change radically.

Release Cancelled—Fall 1985. By September, MicroProse developers were working feverishly to meet their November deadline. Retailers, distributors, and consumers were eagerly awaiting *Gunship.* The product had been announced at the 1985 Summer CES show and heavily advertised.

In the meantime, Sid Meier, MicroProse co-founder and game designer, had been working on some ideas for basic 3-D graphics. He took a month, using the speed and graphics capabilities of the Amiga, to produce a simple demo of *Gunship* using his new graphic ideas.

"It was impressive," said Hollis, "The graphics he showed us were more realistic than the original, almost abstract graphics . . . a tremendous improvement over what we had." At the same time, Stealey was unhappy with the simulation. "It just didn't give you the real feel of piloting a helicopter," he said. "The urban missions weren't realistic for the Apache helicopter and the graphics just weren't doing the job."

MicroProse had already spent a year on development and the expected release date was only two months away. After several days of agonizing decision making, Stealey announced an indefinite postponement of the release date and forced the project back into massive redevelopment. Among industry pundits, *Gunship* became labelled as "vaporware."

"I've always said that Microprose would produce only quality products and would try not to capitalize on quick development," Stealey retorted. "When I considered the problems with the simulation—it wasn't bad but it wasn't great—and saw the possibilities of Sid's new graphics, I didn't have any other choice. We decided to throw six months of our work away and start over."

Another Year—Oct. 1985–Oct. 1986. It was time to re-examine the development plan for *Gunship*. Hollis began working on a method to implement Meier's graphics ideas on an 8-bit computer without sacrificing any speed. It took him several months to complete. Meanwhile, a recent addition to MicroProse, noted game designer and history buff Arnold Hendrick, began painstaking research of the AH-64A Apache and the type of mission it would most likely fly.

"The AH-64 was just starting off the McDonnell-Douglas production line at the time," said Hendrick, "and most specific information, like the cockpit configuration, was classified." But advertisements by McDonnell-Douglas and the unclassified material available on the Apache revealed the basic parameters of the weapons it would probably carry.

After researching the weapon systems and operations, he had to weigh game play against reality. "Some things just had to be simplified," Hendrick said. "We knew the arming sequence for the weapons on the real Apache was a complicated procedure . . . it's a safety feature. In our simulation it's only one step. But replicating the complete process would have been pointless complexity and added nothing to the game."

By January 1986, Hollis had finished his work on the 3-D graphics and created the mechanism to include different geographic "worlds" in the simulation. Now he needed real data for the worlds and realistic missions to implement.

Hendrick knew that Europe was considered an "expected field of battle" in military circles with NATO forces combatting the Warsaw Pact nations. He created a "world" using a detailed topographical map of Western Europe as his

model. "The Apache helicopter was designed as a day-or-night tank killer," he said, "so it was ideally suited to this region where intensive land battles could occur." Soon, Hendrick had developed a number of missions in Western Europe.

Meanwhile, screen graphic artist Michael Haire was busy designing a cockpit layout, game options, and award screens for *Gunship.* Michele Mahan executed the artwork. "We designed three versions of the cockpit before we were satisfied," Haire said. "Obviously we had to simplify the actual Apache cockpit and change the sizes of the gauges so they were readable on a computer screen."

The options and awards screen presented special problems. "You'll notice that the awards screens look over the shoulder of the person receiving the medal or only show hands. Our main concern was producing screens that everyone could identify with," Haire said. "We wanted the people who completed a mission to feel that they were personally being rewarded . . . not some mythical character."

Gunship was really taking shape by the spring of 1986. Greg Tavares, using his animation techniques, took Haire's screen designs and made them work with the simulation. He added the pointer used on the selection screens and "polished" the explosion and flak graphics. Later he added the logic for the air-to-air, heat seeking, and laser-guided missiles.

Hendrick continued to research and develop more "worlds" and mission scenarios for *Gunship.* "We looked at where the U.S. Army was training to fight these days," he said. Using public sources, military acquaintances, books, and magazines, he decided on the Middle East and Central America as two other regions to add to the simulation. "You won't find a book that says that the U.S. is training to fight in a specific region," he said, "but you will find parenthetical references. I just extrapolated the two missions from those references."

The Southeast Asia "world" was selected because "it's the only place American helicopters were used in a significant way," said Hendrick. "From a gaming standpoint, Vietnam had a lot to recommend it. One of the problems of Vietnam was seeking out and finding the enemy, and it's difficult in the Vietnam missions in our game also."

The End Result. By the end of the summer, Hollis had worked the new worlds into *Gunship.* The majority of the simulation was complete; play-testing was well underway. The team started "fine tuning" the simulation, adding the little extras, and removing some small bugs from the code.

With a great sigh of relief, *Gunship* was released in October 1986—almost one-and-a-half years after it was first announced. MicroProse took some abuse during that year, with the *Gunship* title appearing on "vaporware" lists throughout the country.

But Stealey had no regrets. "It cost us some money," he said, "and for a while, our credibility probably suffered. But I haven't regretted the decision. Magazine reviews and customer letters unamimously have said that it was worth the wait. In the long run, I'm sure MicroProse's reputation as a quality software developer has been enhanced."

"It's hard for a simulation to be all things to all people," Hollis said, "but I think *Gunship* comes as close as possible. We put five man-years into development, way above any industry standard, and I think it shows."

Chapter 12

The Super Simulator

Chapter 12

Training a crew to fly and fight with the Apache is no easy task. The aircraft was designed to fight at maximum standoff range to increase survivability, but in practice, live rounds are never fired at the limits of their range.

Finding a place to practice is another major problem. The TADS targeting system uses a powerful laser which could be dangerous to people or animals in the training area. Practice areas with suitable terrain are scarce in the U.S. and don't exist at all in Europe (due to the density of the population), yet most of the Apaches will be stationed there.

With Apache training costs running almost $3,000 per hour, Hellfire rounds running $30,000 each, and 30mm gun rounds going for $13.70 apiece, it was obvious that a training simulator was needed. Proposals were received and Singer/Link was awarded the contract. Having previously designed and built the simulator for the Space Shuttle, Singer/Link seemed a natural choice to develop the even more sophisticated simulator needed to train crews for attack helicopter missions.

The Combat Mission Simulator (CMS) developed by Singer/Link is truly *the* most advanced simulator operating today. It is the first military simulator that really fights back, thus providing a true combat experience. This is very important as only 25 percent of the pilots in the Army today have any experience in combat and none have experience against the newer Warsaw Pact front-line weapons.

With the CMS, pilots can not only sharpen their flying skills, but can also get the feel of combat and psychologically prepare themselves. They have a chance to learn to overcome the tendency to freeze up when under fire for the first time.

Figure 12-1. A Simulator Pilot Maneuvers Against Two Soviet Hind Helicopters

Thirty-eight 32-bit computers working in parallel with central timing are required to provide the control and realism required by the Army. The mainframe units are state-of-the art Perkin-Elmer 3250 processors. The system is most easily understood by looking at its major components individually.

The Battlefield

Developing the simulated battleground for the Apache simulator posed quite a task to the design team. Providing hills, mountains, streams, roads, and an occasional target was all that had been previously required for jet simulators. Jets fly at high speed and rarely go below 500 feet, and as such, the ground design passed so fast that real detail was not needed.

The Apache, however, is designed to operate at low speeds very close to the ground, at an altitude of 10–15 feet. In order to fly in this manner, the simulation needs to provide very real clues as to altitude and ground contours. The simulator battle area is 32 × 40 kilometers. Current computer technology is not capable of presenting the necessary detail over this large an area. To compensate for this, the team built the entire operating area out of 1-kilometer-square blocks. Highly detailed blocks for nap-of-the-earth (NOE) flying were developed and linked together to form corridors for low-level flying. These were surrounded by less-detailed blocks.

These blocks are combined to form two main areas: the Airfield Area and the Tactical Area of Operations.

The Airfield Area is 12 × 27 kilometers. Located in the center is a complete model of a modern airfield. The model includes buildings, roads, telephone poles, high-power lines and towers, trees, and a nuclear power plant. This area is surrounded by mountains with two passes leading to the combat area.

The Tactical Area of Operations, or gaming area, is 27 × 27 kilometers square, and most of it is highly detailed and designed for NOE flight. Thirty-four battle positions are included; while most are on the high ground, a few are down

in the valley. Enemy forces are placed in these areas at the discretion of the instructor. Visual clues are included in the scenery to aid the crews in navigation. Hills are topped with water towers and microwave links, and a complete road system is included. Hazards such as high-power lines, tall antennas, and telephone poles must be mapped and avoided.

In addition to these visual clues, a complete 1:50,000-scale topographical map has been used with a simulation for the first time. This map is as complete and accurate as any currently used in the real world. Crews will also receive preflight intelligence briefings as well as in-flight information from scout helicopters.

A great deal of time and effort went into producing an environment as similar to Central Europe as possible. All geographic and manmade obstacles likely to be encountered in a real battle were included. The outstanding result allows crews to practice day, night, and bad-weather flying, and to practice combat in a realistic environment.

The Apache and Weapons Systems

The numerical model used to simulate the Apache is the most complex aerodynamic algorithm used in an Army simulator to date. In an attempt to make the simulation as real as possible, the cockpit is identical to that of an Apache and all instruments and displays function as they would aboard the real aircraft. Both crew members use the IHADSS helmet. Views of the outside are provided with a display screen outside each of three windows.

The effect of firing weapons is factored into the model also. The crew feels and hears the result of firing a Hellfire Missile or the 30mm gun, and the aircraft reacts appropriately. Even making mistakes has a realistic effect. If the aircraft is not high enough to launch a missile without it hitting the ground, the missile will explode beneath the helicopter—resulting in a significant jolt to the crew and possible damage to the aircraft. A similar situation will result if the aircraft is not sufficiently above a ridge used for cover when

firing. In this case, the crew would see the missile hit the ridge in front of them with the resulting bright flash and possible damage.

Mistakes like this are the best argument for realistic simulations. If they were made in combat or even in training with live rounds it could be very dangerous to the crew—not to mention expensive (with Hellfire rounds running $30,000 a pop).

All weapons can be visually observed in flight toward the target. If the weapon is correctly aimed, either a *hit* or a *kill* will be recorded, depending on the type of weapon fired and the hardness of the target. Trucks can be hit and killed by the 30mm gun, but a battle tank can only be hit. Anything a Hellfire missile hits is considered killed.

The Enemy Threat

A great deal of effort has gone into the modeling of the enemy weapons to be faced in the simulator. They need to be as lethal and as smart as the real thing or the whole process is meaningless. These systems must constantly attempt to sight and engage an Apache and, when all appropriate constraints are satisfied, to register an Apache kill. All types of Soviet weapons are used in the simulation: T-80 Tanks, BMPs, ZSU-23-4 antiaircraft guns, SAMs, and even Hind-D helicopters are modeled. The best information available regarding these weapons are used in the model, including the following:

★ Ammunition type
★ Maximum rate of fire
★ Number of rounds fired at the Apache
★ Apache range
★ Muzzle velocity or missile time of flight
★ Effects of poor visibility
★ Time of day
★ Effect of proper use of backdrop when unmasking
★ Effect of Apache countermeasures; that is, jammers, flares, and chaff

The instructor can choose one of ten levels of difficulty. These levels change the enemy weapons' lethality to correspond to the crew's level of expertise. Once this level has been established, the computer will constantly evaluate the above factors in deciding whether a hit or near miss occurs. If a hit occurs, the crew will feel it and hear the impact, and the aircraft will react. Depending on the size and type of round, an appropriate damage level will result. The simulation will continue after a hit, forcing the crew to make important decisions, such as continuing the mission, returning to base, or making a forced landing.

The enemy threat has been superbly designed for this simulation and given a large amount of "intelligence." They'll fight to win and survive just as hard as the Apache crew.

Instructional Features

For each of the two trainee positions, there is an instructor position located behind the trainee cockpit on the moving simulator platform. The instructor is equipped with many of the same instrument displays and visual screens as the trainee. The simulator provides the instructor with a number of features which allow control of the learning process much more than is possible in an actual aircraft. Here's a description of some of these features.

Malfunction insertion. This feature lets the instructor insert various sets of malfunctions into the simulation. As the student progresses in training, more malfunctions are inserted at the same time. The system has the capability to cause as many as ten malfunctions in one set—quite enough to try the courage and intellect of even the best pilots.

Performance recording. The system can record a trainee's performance when engaged with an enemy weapon. All important information is recorded including number of shots fired, type of threat weapon, hits scored, aircraft performance, and heading. This data can be played back at a later time to evaluate and analyze a trainee's performance.

Automatic flight. The pilot and copilot/gunner's simulator cockpits are completely independent modules. The instructor for the CPG station can use the Automatic Flight Mode of the simulator to let the computer fly the aircraft while the CPG practices various duties. A number of different 15-minute preprogrammed exercises have been developed for this purpose.

Target control. The instructor has complete control over the simulated targets. This control includes where they're placed, which ones will shoot back, how lethal they'll be, and what types of threats are to be used. Fifteen types of enemy weapon options—ranging from trucks and personnel carriers to T-80 tanks and SA-9 surface-to-air missiles—are available. Even Soviet Hind-D helicopters can be realistically simulated.

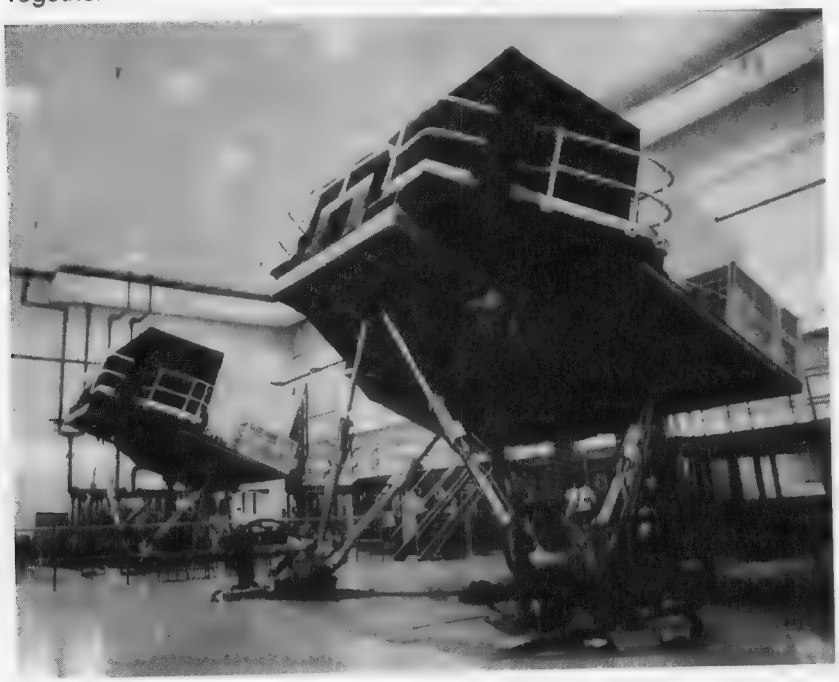
Future Enhancements

As good as the AH-64A CMS is, the Army and Singer/Link believe that they can make it better. One area where a lot of work is currently being done is in the ground texture and contours display. The current system uses software to create a checkerboard-type grid over the ground to give the pilot some sense of altitude and contour. These grids, however, are 50 × 50–foot squares and as the pilot flies closer to the ground, only one or two grids can be seen. This reduces the pilot's ability to fly NOE maneuvers. Using Hardware to produce the ground textures will free up processing capability and allow for much greater detail in the display. Textures ranging from water surfaces to waving wheat fields to plowed fields can be created using the hardware system soon to be installed.

Pychological testing can also be performed with the CMS. Crews can be stressed to their limits to see how they react. Crew members can also be tested together to maximize compatibility. Combat is not a good place to learn that you and your partner don't get along when under stress.

Other changes to be made include the addition of air-to-air combat (currently not available). Hind-D helicopters can

Figure 12-2. The Pilot and Copilot/Gunner Simulators Being Operated Together



be targets but cannot shoot back. Another exciting future project is the use of high-resolution military satellite photography to create a simulation database based on real locations anywhere in the world. With this system, pilots will be able to practice in the simulator over the actual terrain in which they might have to fight in Europe or the Middle East.

Appendices

Appendix A

Suggested Reading List

If you would like to read more about attack helicopters and their role in the modern Army, I would suggest the following:

Cockburn, Andrew. 1984. *The Threat: Inside the Soviet Military Machine.* New York: Vintage Press.

Gunston, Bill. 1986. *Osprey Combat Aircraft Series: AH-64 Apache.* London: Osprey Publishing Ltd.

Gunston, Bill, and Spick, Mike. 1986. *Modern Fighting Helicopters.* New York: Crescent Books.

Mason, Robert. 1983. *Chickenhawk.* New York: Viking Press.

Richardson, Doug. 1987. *Modern Fighting Aircraft: AH-64.*(Vol. 12). New York: Prentice Hall Press.

U.S. Army Aviation Digest. A monthly periodical covering Army Aviation issues. Available at larger libraries or by contacting The Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

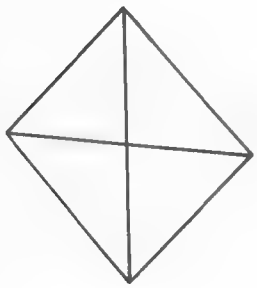
Appendix B

Drawing Legend

Throughout this book, various points and concepts are illustrated through the use of drawings. Below is a legend to these drawings, which should make them easier to use and understand.

AH-64 APACHE 

MI-24 HIND 

HILL 

APACHE FLIGHT PATH ————————

HIND FLIGHT PATH - - - - - - - - - - - -

WEAPON FLIGHT PATH .....

Glossary

AA
Antiaircraft.

AGM
Air-to-ground missile.

AH-1 Cobra
The first true attack helicopter.

angle of attack
The angle at which a wing or rotor blade comes into contact with the air.

autorotation
The act of using the forward motion of the helicopter through the air to keep the rotor blades spinning when engine power is lost.

chaff
Millions of small strips and slivers of foil and metal-coated plastic which are dispersed into the air to confuse radar tracking.

chin
The bottom area on the front of a helicopter.

collective
The helicopter control which changes the pitch of the blades at the same time in order to lift the aircraft.

CPG
Copilot/gunner.

CRT
Cathode ray tube, video screen.

cyclic
The helicopter control which changes rotor blade pitch in only half of its revolution to control direction of flight.

ECM
Electronic countermeasures.

FFAR
Folded Fin Aerial Rockets.

fixed-wing aircraft
Airplanes.

FLIR
Forward Looking Infrared sensor; used to see objects at night or in smoke or fog.

HDD
Head Down Display.

HQ
Headquarters.

HUD
Head Up Display.

IFR
Instrument flight rule.

IHADSS
Integrated helmet and display sighting system.

IR
Infrared.

mike-mike
Term used to mean millimeter.

mm
Millimeter; used to measure the size of various weapon projectiles.

NOE
Nap of the earth; refers to flying at the lowest possible safe altitude to use terrain features and manmade objects to hide the aircraft.

OH
Observation helicopter.

pitch
The angle of the rotor blade.

PNVS
Pilot Night Vision Sensor.

rotary-winged aircraft
Helicopters.

rotor disc
An imaginary disc created by the rapidly spinning rotor blades.

SAM
Surface-to-air missile.

TADS
Target Acquisition Designation Sight.

torque
The force that causes rotation.

unmasking
Letting the aircraft come into view of the enemy. Unmasking is generally necessary to fire upon the enemy.

VFR
Visual flight rules.

wire guided
A missile guidance system in which the fired missile trails a set of very thin wires which are connected to a control panel. The operator uses these wires to "fly" the missile to the target.

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GUNSHIP ACADEMY

Tactics and Maneuvers for Attack Helicopter Simulations

Richard G. Sheffield

A **COMPUTE! Books** Publication

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Foreword

You've finally made it. You busted your hump for two months in basic training, you showed superior leadership skills in Warrant Officer Development, and they still are talking about you at the Army Aviation Center in Ft. Rucker, Alabama. You were a natural helicopter pilot, the first to solo, and you graduated tops in your class. Training in the AH-1 Cobra was exciting, but you wanted more. And now you've got it—orders to a unit to fly the AH-64A, the pinnacle of Army aviation.

Now it's back to school again, but this is no ordinary school; this is probably the most exciting school in the world—*Gunship Academy.* This is your Academy textbook and with it you learn the ins and outs of your Apache Gunship, how to fly it in combat, and how to fight and win with it.

In *Gunship Academy,* we take first things first. Initially, you'll learn about the Apache, its weapon systems, and helicopter aerodynamics. Once you are ready to fly, you'll be guided through a series of progressively harder tutorials designed to teach the basic skills you'll need to survive on the modern battlefield. Following that, advanced attack helicopter tactics and strategy will be covered, including air-to-air combat and defensive plans. You'll learn to strike deep behind enemy lines, where it hurts the enemy the most, and live to brag about it and be decorated. Want to win the Congressional Medal of Honor? You'll learn what it takes and the skills necessary to garner the nation's highest award.

So you had better get started, because things are heating up in Western Europe. Soviet T-74 Main Battle Tanks and

BMPs are racing across the German border, and the Hind helicopters are as thick as flies. Arab extremists are attacking in the Middle East, Cuban-backed forces are expanding in Central America, and things are still a mess in Southeast Asia. They need you at the front as soon as possible. So strap on your IHADSS helmet and wind up your engines. *Dust off is in five minutes!*

Preface

I was one of the thousands of computer game enthusiasts who anxiously awaited the release of *Gunship* by MicroProse. At the time, I was familiar with other games by MicroProse so I expected a very good game, but even I was surprised by the excitement, realism, and complexity of *Gunship*. I get so worked up playing this game that I can't play it after 10:00 at night or I'll never get to sleep because it takes me too long to calm down!

It became immediately obvious that there was a lot to learn about this game, so I started the research which led to this book. It is amazing how well the real Army attack helicopter tactics and strategies translate to this game. The more I learned about the way real Army pilots fly missions, the better my scores got.

My education was completed on a snowy day in early November when I visited the MicroProse facility in Hunt Valley, Maryland. There I spent the afternoon talking with game designers Andy Hollis and Arnold Hendrick, and with Alan Roireau (a play-tester who played *Gunship* all day long for weeks during development). They helped me learn how the program actually worked, and again my scores immediately shot up. What I learned from the guys at MicroProse formed the basis for the "Tips and Information" chapter. This turned out to be the longest chapter in the book and certainly one of the most helpful. The scoring system that they use is clever yet complex, and learning how it works will go a long way in improving your scores.

While I was developing this book, two new helicopter simulation games were released: *Thunderchopper* by Action-Soft in Urbana, Illinois, and *Tomahawk* by Datasoft in Chatsworth, California.

Players of both of these games should benefit by reading this book. Although this book was written around *Gunship*, most of the tactics and overall strategies translate well to other games. But if you have not seen *Gunship* in action, by all means take a look. I highly recommend it.

Good luck and good hunting,

Richard G. Sheffield

Acknowledgments

The author wishes to thank everyone who helped in the development of this book. Special thanks go out to the following people:

Everyone at MicroProse Software, for a first-rate job in developing *Gunship*. In particular, I would like to thank Mike Harrison, Andy Hollis, Arnold Hendrick, and Alan Roireau for taking time to talk with me on a snowy afternoon. I enjoyed my visit.

Jim Ramsey, with McDonnell Douglas Helicopter Company, for providing photos of the AH-64A Apache.

Richard Adams, with Singer/Link Flight Simulator Division, for providing photos and information on the Combat Mission Simulator.

Mr. Vinci, with Rockwell International Missile Systems Division, for photos and information on the Hellfire missile.

GUNSHIP ACADEMY!

Welcome to the exciting world of *Gunship!* Here, you can fly an AH-64A Apache attack helicopter to defeat Soviet Hind helicopters in combat—and win the Congressional Medal of Honor for your effort!

Gunship Academy, COMPUTE!'s companion book to the simulation, holds much more than insider's tips on how to play the game. Learn the history of the Apache, what it takes to become a real Apache pilot, and how Apache attack helicopters and their weapons systems work.

Inside, you'll find

★ The development and design of the AH-64A Apache
★ Helicopter aerodynamics
★ Apache pilots and their training
★ Weapons systems—theirs and ours
★ Attack helicopter basics
★ Air-to-air combat
★ Defensive tactics
★ The Apache simulator
★ Game-playing tips and hints from the experts
★ Glossary of terms

Written in clear, direct prose and filled with photos and drawings that elegantly illustrate important military maneuvers and tactics, *Gunship Academy* is *your* best flight instructor for the *Gunship* AH-64A Apache attack helicopter.

Noted writer Richard Sheffield is also the author of *Jet Fighter School: Air Combat Simulator Tactics and Maneuvers*, and *Sub Commander: Tactics and Strategy for WWII Submarine Simulations.*

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